the OIL AND GAS JOURNAL

AUGUST 1, 1955

New Guatemalan Law Disappointing 76

World Output Slips in Upward Climb ... 78

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L.P.G. goes underground

. . . Storage now at all-time high — and end not in sight

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New drawworks has more horsepower

... and TIMKEN® bearings

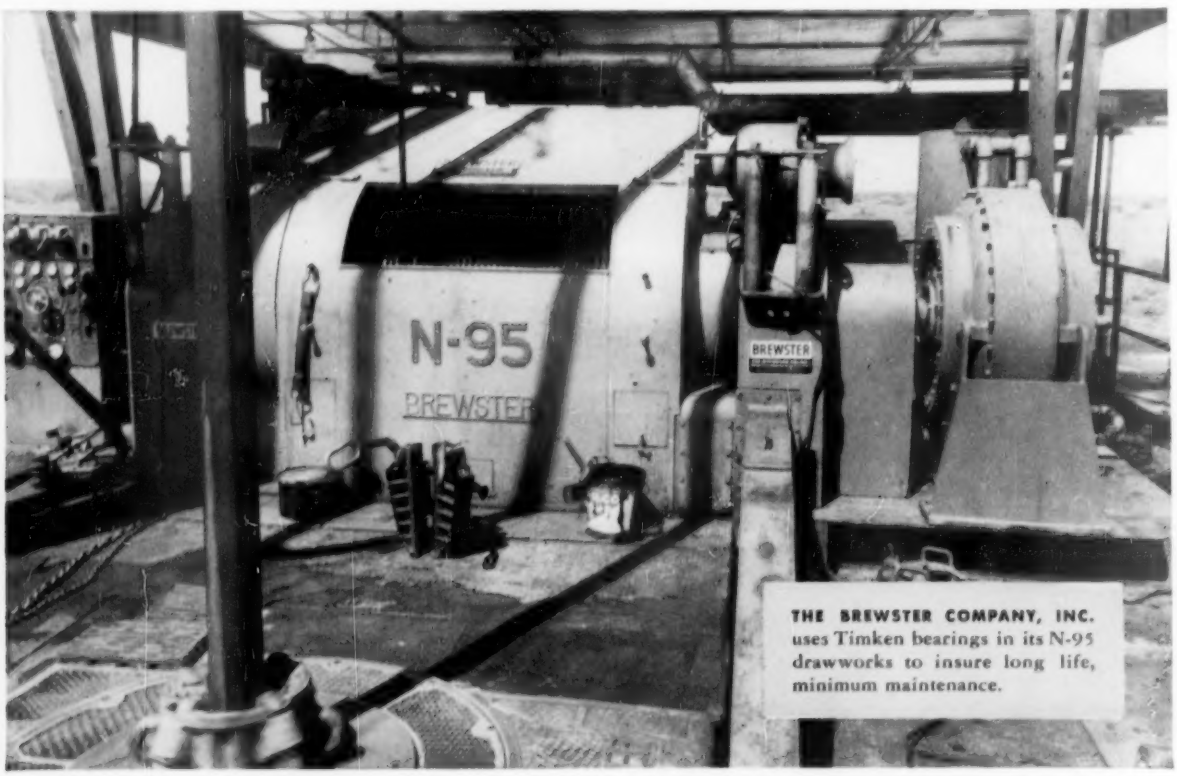
THIS new N-95 drawworks, built by The Brewster Company, Incorporated, has all the features that have made Brewster rigs famous. And it has the added advantages of greater horsepower, bigger main drum and heavier construction for deeper drilling. Another big plus is that the N-95 is equipped with Timken® bearings. That means longer life and less chance of breakdowns even under the toughest drilling conditions.

With Timken tapered roller bearings under sprocket hubs, the sprockets run true and trouble free. The tapered construction of Timken bearings enables them to take radial and thrust loads in any combination. Friction is virtually eliminated due to the fact that Timken bearings are designed, by geometrical law, to have true rolling motion. And because they're made to extreme limits of precision to deliver the low friction made possible by this design. To get steel good enough for Timken bearings, we make our own. We're the only U. S. bearing manufacturer who takes this extra quality precaution.

Timken bearings hold housings and shafts concentric, make closures more effective. Dirt and moisture are kept out, lubricant is kept in. Maintenance and lubrication costs are negligible.

Building or buying new oil field machinery? Specify Timken bearings and look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



THE BREWSTER COMPANY, INC. uses Timken bearings in its N-95 drawworks to insure long life, minimum maintenance.

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NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION →✳←

PAGE 1 ONE . . . a glance ahead

Method for sealing off water zones when drilling with air is big problem now receiving much research. Tests are being made with various slow-setting plastic-like liquids for blocking permeable sections. Some favorable results have been obtained but so far costs are close to prohibitive.

Petroleum-based synthetic detergents have gone about as far as they can go in invading the soap market, now seek other markets. Manufacturers' research indicates big new outlets can be built for use in emulsifiers, foam-type plastics, poultry food, soil conditioners, and other products.

Western Canada anticipates a busy decade of oil and gas pipeline construction on the assumption that new markets will develop rapidly—chiefly in the U. S. Many oil and gas fields are shut in or underdeveloped for lack of outlet. Thousands of miles of pipelines will be needed eventually.

Look for further installations to use new processes in upgrading natural and recycle gasoline. Ice appears to be broken after long buildup of technical and economic research, and there may be rapid and sweeping changes in handling of natural-gas liquids and their market outlets and profit margins.

Demand for heavy fuel oil is exceptionally strong both in U. S. and worldwide and is expected to continue at least through next winter. Explanation: High industrial activity, European shift from coal, declining refinery resid yields. Effects: Less foreign resid seeking U. S. markets, better demand for low-gravity crudes.

Refinery prices of petroleum products have risen less, proportionately, than crude-oil prices since the war, thus narrowing refiners' margins. Significance: Refiners have made relative greater gains in productivity and efficiency than producers, passed savings on to consumers; but producers' average costs climb as old, lower-cost reserves are used up.

the OIL AND GAS JOURNAL

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TECHNOLOGY—OPERATION

How to Get Maximum Recovery from a Dry-Gas Field 80

By D. H. Stormont

Wild Goose field in northern Sacramento Valley, California, is an excellent example of how a gas field should be operated to obtain maximum ultimate recovery. The discovery well was completed at the very crest of the dome-like structure. Unitization was carried out early and easily.

Star Patterns—An Improved Seismograph Technique 82

Field work has proved the worth of star patterns in laying out geophones in hard-to-shoot areas. This arrangement can effectively overcome troublesome seismic disturbances and produce a clear picture. It has opened the door to successful seismographic operations in many problem areas of the world.

Why Oil-Well Tubing and Casing Fail—2 84

By H. G. Texter

This second article in a series on casing and tubing troubles deals with failure by bursting, failure of the last engaged thread, leakage, and crushing.

Water Injection Curbs Engine Detonation 92

By R. S. Cramer

Recent tests on a 1,650-hp. pipeline compressor engine shows that water in the form of fine droplets can be injected into the scavenging air system to prevent detonation. Over-all engine efficiency is raised by this procedure.

How to Get Your Ideas Across Orally 95

By G. A. Hartsook

Often a good idea that would help your company is killed in "official channels" before it has a chance to be tried. The most likely cause is poor communication on the part of the man who originated the idea.

Crooked Holes and How to Drill Them Straight 98

By John W. Speer and George H. Holliday

Methods of controlling deviation which do not interfere with drilling progress contribute materially to reductions in drilling costs. The purpose of this article is to outline these methods by pointing up factors that affect deviation and analyses of field results.

Why Cosden Chose HF Alkylation 102

By A. R. Orr

Cosden chose HF rather than sulfuric acid alkylation at its Big Spring, Tex., refinery because of the difficulty of disposing of spent sulfuric acid. The plant departs from normal HF plant practice in several respects including use of a mixed feed and application of horizontal contactors.

Which Type of Instruments Should You Use—Electronic or Pneumatic? 106

Here's a fair and impartial discussion on the advantages and disadvantages of pneumatic and electronic instruments. Application of electronic instruments is probably due for a big increase, but there will always be a number of uses for pneumatic controls.

Pipeline Patrol: Planned Retirement for Pump Units; New 10,000-Hp. Gas Turbine 119

Replacement of gathering engines before costs of operation start to rise sharply will save dollars to pay for a new unit. . . . New 10,000-hp. gas turbine, developed for other use, may find acceptance in pipeline compressor stations.

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they'll be cleaned with . . .

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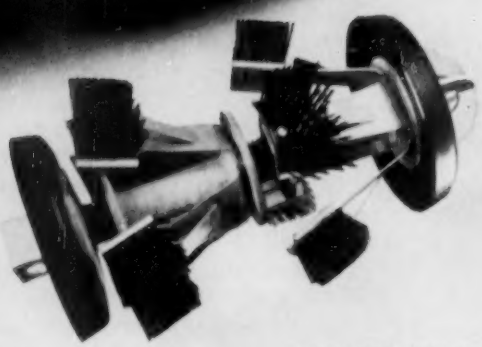

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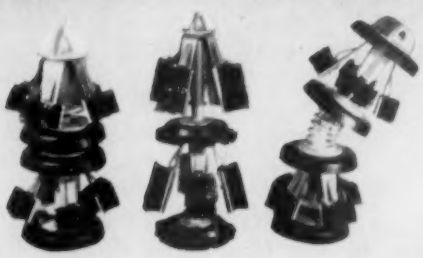

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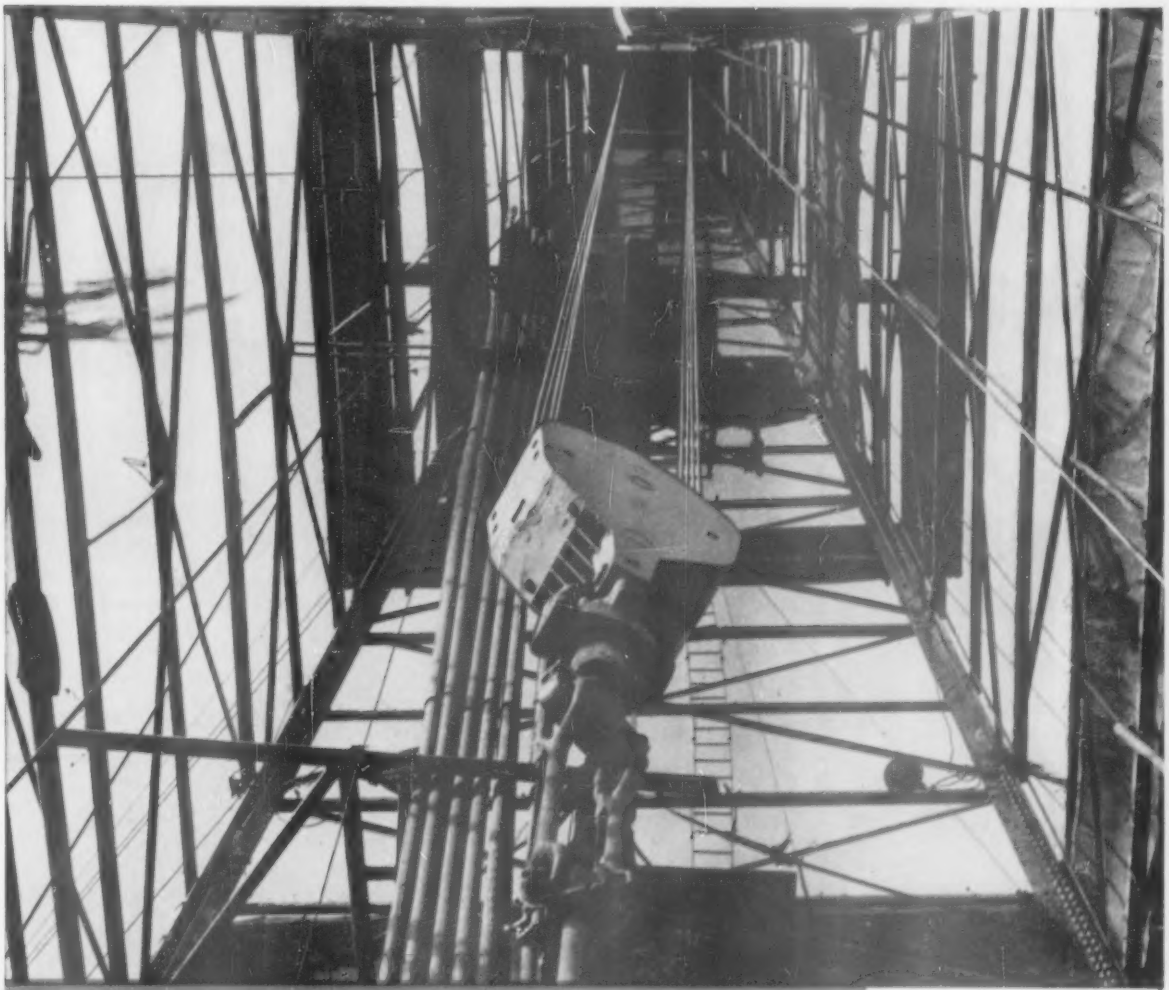

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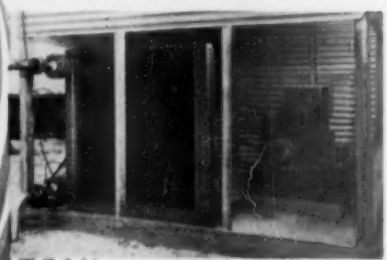
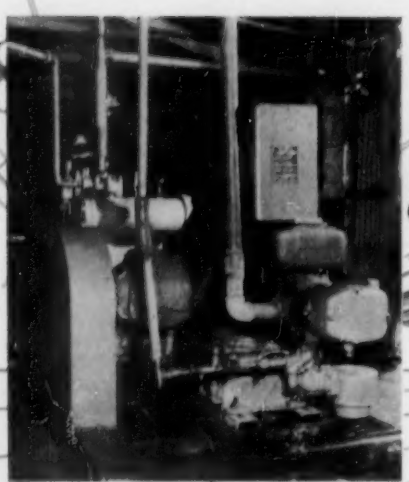


Operating Compressor Cooling Unit Fans



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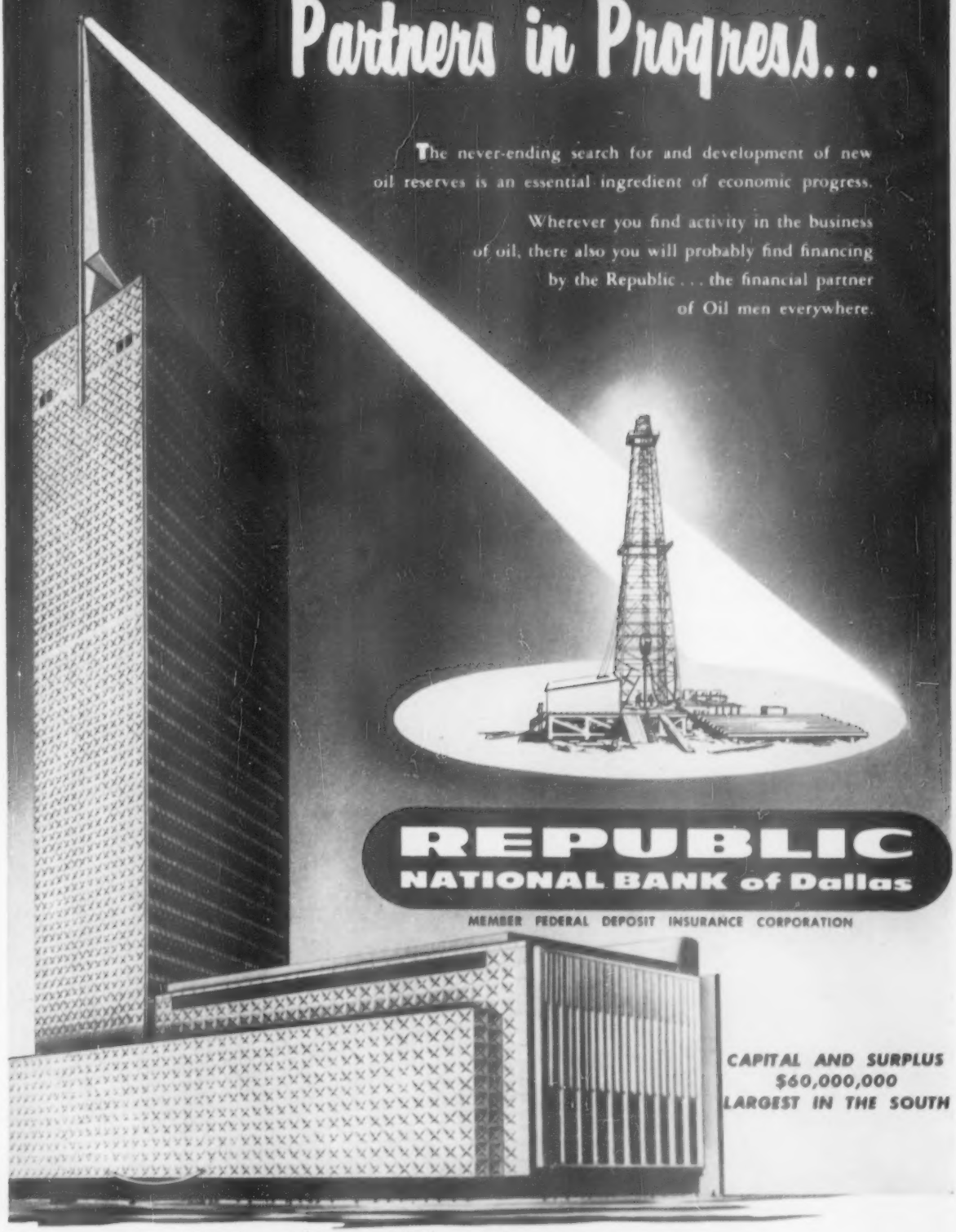

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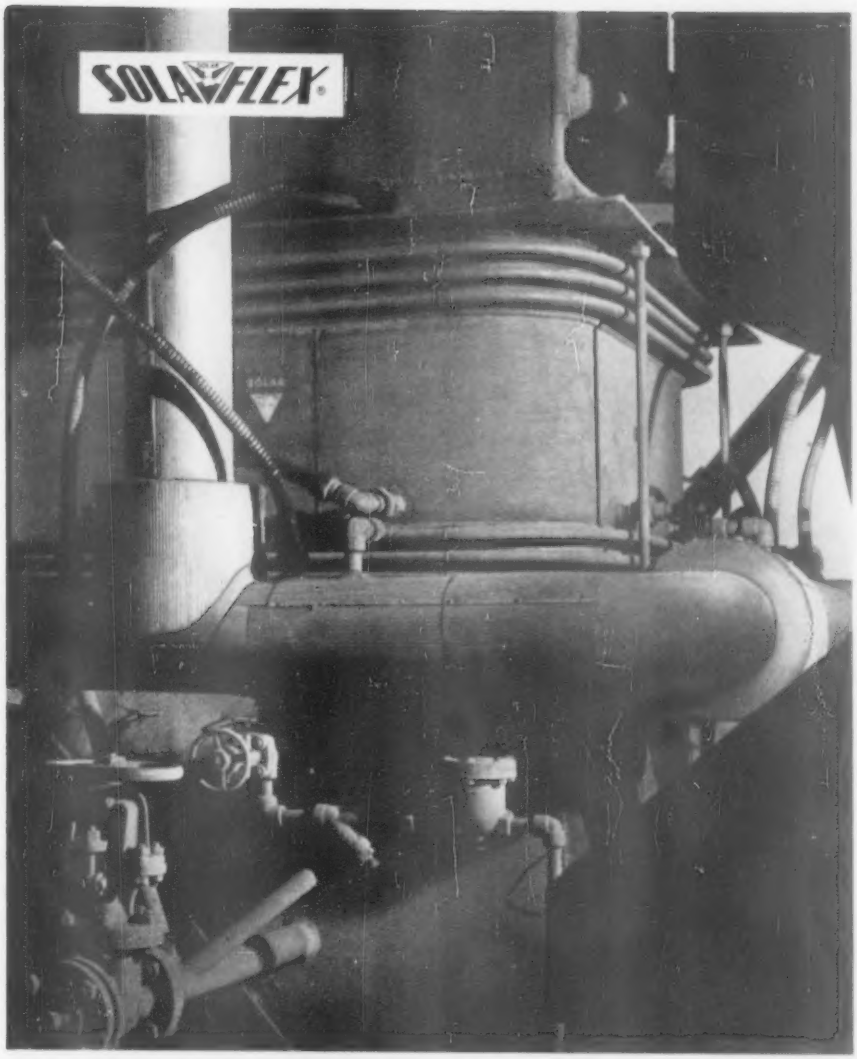

Sola-Flex also accommodates movement in rectangular ducts

AT SHELL'S DOMINGUEZ refinery, the 42-inch rectangular Sola-Flex expansion joint shown above is installed in a flue gas duct leading to the electrostatic precipitator. The Solar unit works in an operating temperature of 575 F, and a pressure of 7 psi, allowing 1 in. of offset movement and ¾ in. of axial movement. Special aeration fittings prevent solids from depositing in the bellows.

Solar rectangular bellows find many uses in oil and petrochemical installations—for durable service in turbine condensers, breechings, high-temperature air ducts and gas turbine regenerators. Solar builds two types of rectangular joints—the U-span and the V-span—in sizes from six by twelve inches up to 20 by 30 feet.

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Eight large wheels, equipped with fast-acting air brakes, evenly distribute the rig's weight. Heavy-duty tires cushion the machine on the highway and off. Since the axles are free to oscillate independently of the frame, the wheels can follow uneven ground without putting undue stress on the frame.

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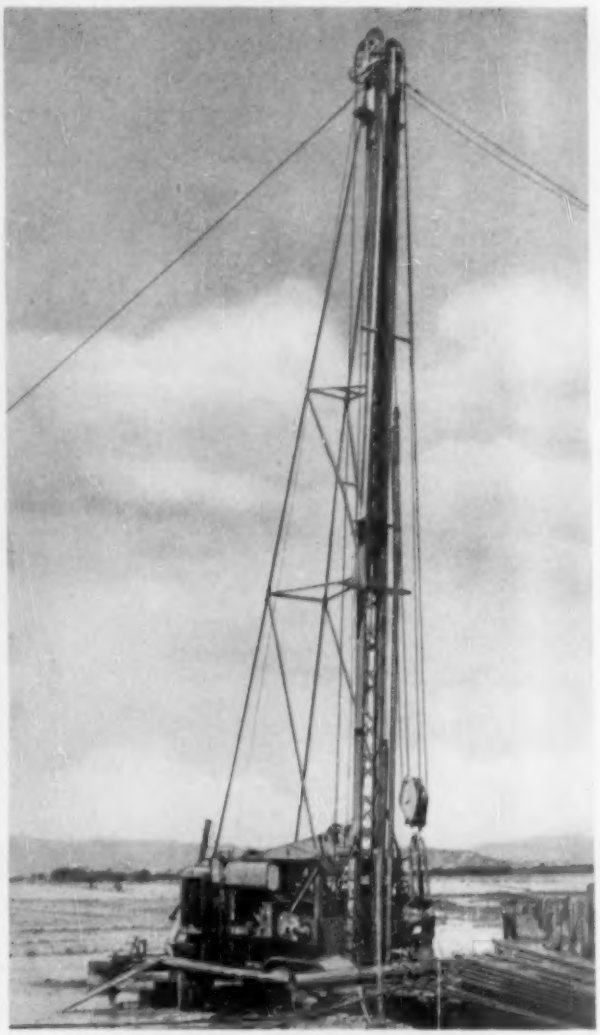
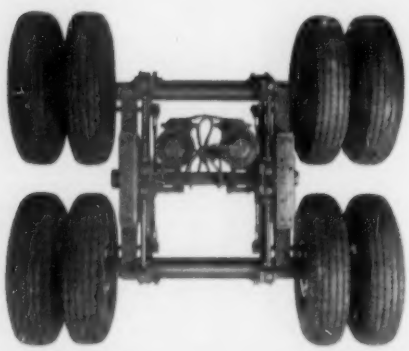
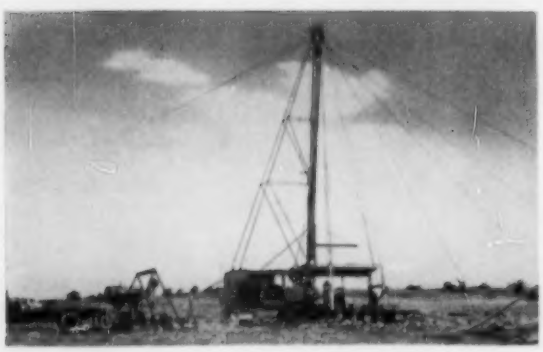




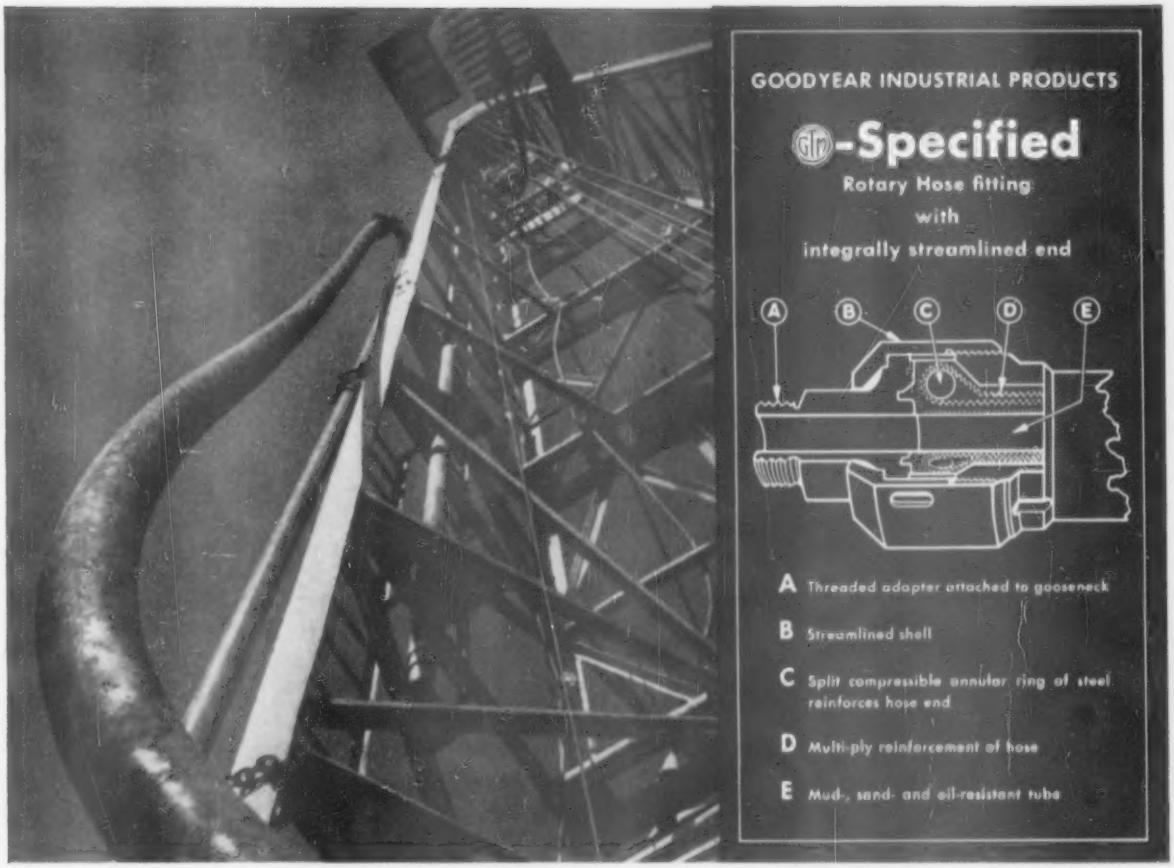


BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

This 36-L spudder, equipped with tandem axle mounting, was drilling-in a well in Oklahoma. Estimated depth was 1,600 feet.

BUCYRUS ERIE



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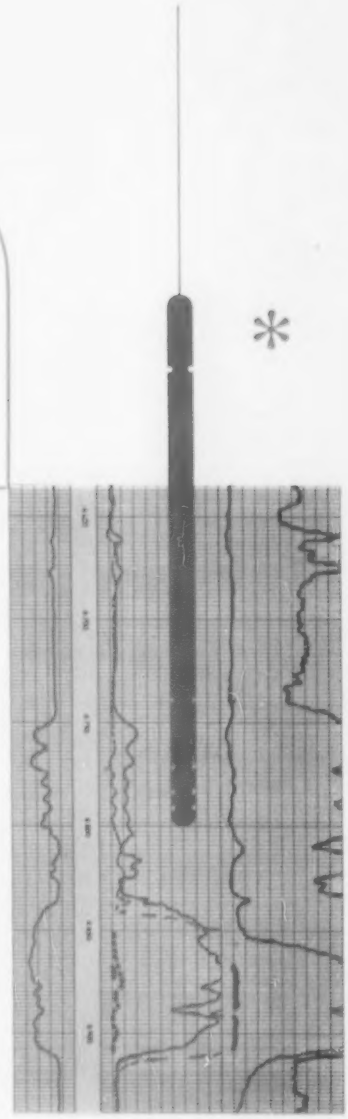


Usual methods of electric logging are more susceptible to cable leakage—leakage that can make a big difference in your final analysis. Since the worth of any electric log depends directly upon the *accuracy* of the information it contains, Halliburton has taken positive steps to plug these leaks.

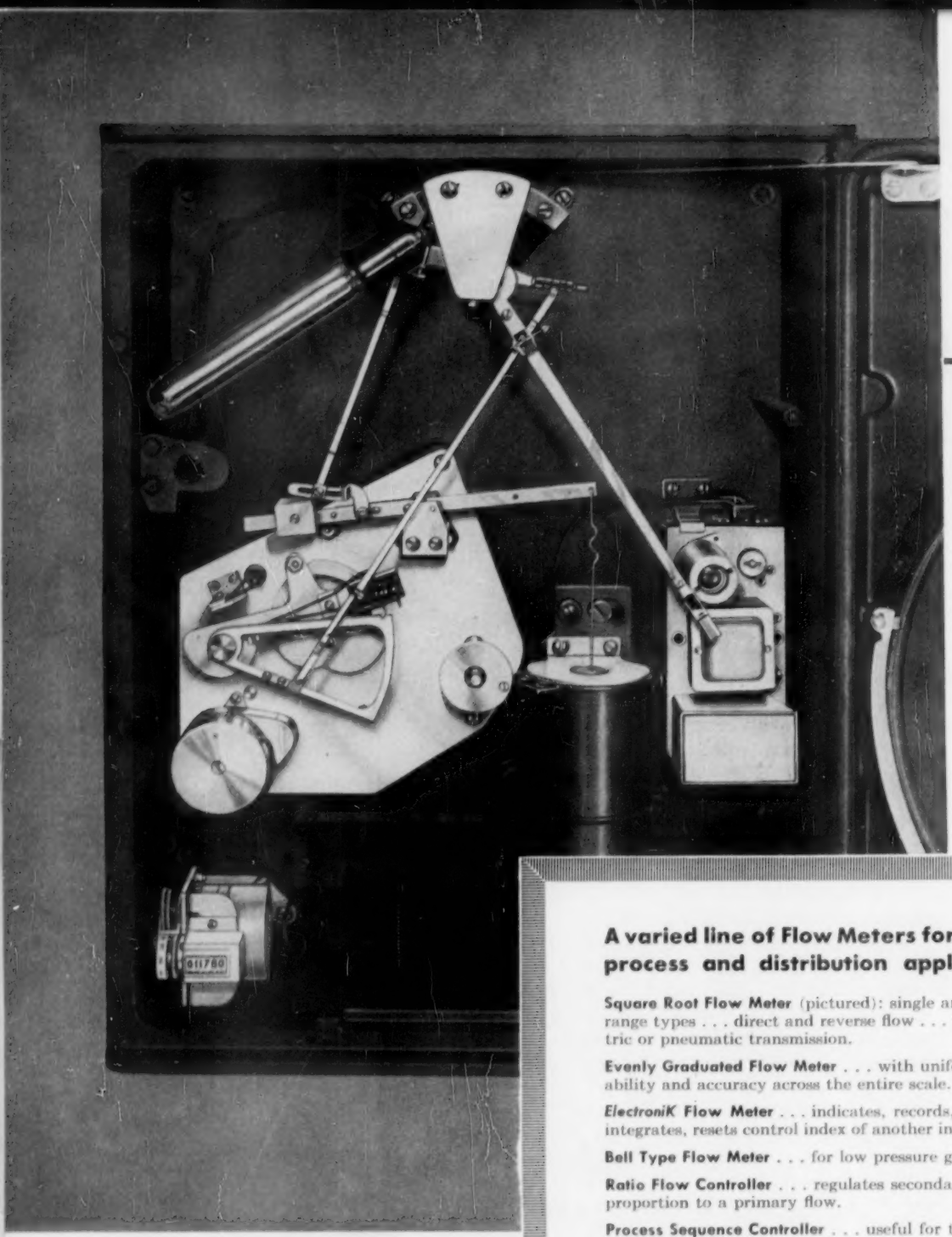
Halliburton's Frequency Modulation Logging gives you pinpoint accuracy seldom found in the usual practices of resistivity logging—and you get all the information on the first run! Cable leakage—prime source of faulty analysis—becomes a minimal factor, since the cable itself is NOT a part of the measuring circuit. Multiple curves are logged simultaneously with zero basing; you get all the information you need in the shortest possible time. The cost? A few pennies per foot!

Electronic FM Logging is faster, more accurate logging with minimal effect of leakage at the cable. A positive advance from other logging methods that require a combination of "intuition" and educated guesswork to interpret their results, with FM Logging you can be *surer* when all the facts are in. So why not get the full story of this entirely new approach to accurate instrumentation? Just call your local or district office of Halliburton Oil Well Cementing Company.

HALLIBURTON

ELECTRICAL WELL SERVICES

250 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG



A varied line of Flow Meters for every process and distribution application

Square Root Flow Meter (pictured): single and double range types . . . direct and reverse flow . . . with electric or pneumatic transmission.

Evenly Graduated Flow Meter . . . with uniform readability and accuracy across the entire scale.

***ElectroniK* Flow Meter** . . . indicates, records, controls, integrates, resets control index of another instrument.

Bell Type Flow Meter . . . for low pressure gases.

Ratio Flow Controller . . . regulates secondary flow in proportion to a primary flow.

Process Sequence Controller . . . useful for timing the addition of reagent to a preset cycle.

Parshall Flume Meter . . . for measuring flow in open channels and weirs.

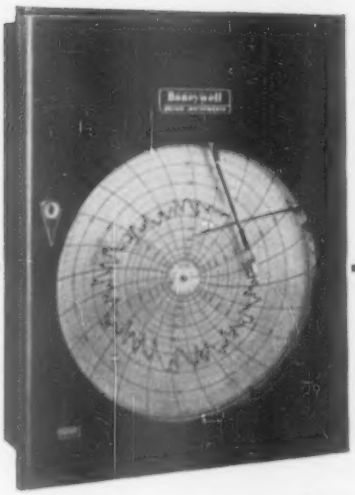
***Tel-O-Set* Miniature Instruments** . . . for graphic panels and other applications where space is at a premium.

Area Flow Meter . . . electric meter body for use with viscous fluids.

Differential Converter . . . the mercuryless flow transmitter with high sensitivity, precision and rangeability.

▲ *Reference Data:*

Write for Catalog 2321, "Flow Meters, Indicating, Recording, Integrating, Controlling."



The Brown Flow Meter line

was designed for **your process applications**

An important reason why Brown flow meters give you better performance is that they were designed specifically for flow recording, integration and control in industrial processes. Far from being step-children of boiler plant instruments, they embody features that fit the needs of modern production technology. Their design has been refined and perfected throughout 28 years of experience in flow instrumentation . . . to assure you of the utmost in precision, versatility and reliability.

For measurement, Brown Flow Meters give you a complete range of meter bodies to work with any fluid at any pressure . . . either electrical or pneumatic transmission . . . and the flexibility of interchangeable range tubes.

For integration, Brown Flow Meters feature accurate, simple electronic flow integration, in a design that places no mechanical load on the measuring mechanism.

For control, Brown Flow Meters, particularly those with square root calibration, offer an unequalled variety of control actions to match the needs of the simplest to the most complex process requirements.

For service, Brown Flow Meters give you basically simple and rugged designs that cut maintenance to the minimum . . . plus the convenience of prompt assistance in start-ups, routine maintenance and emergencies, by Honeywell specialists located near your plant.

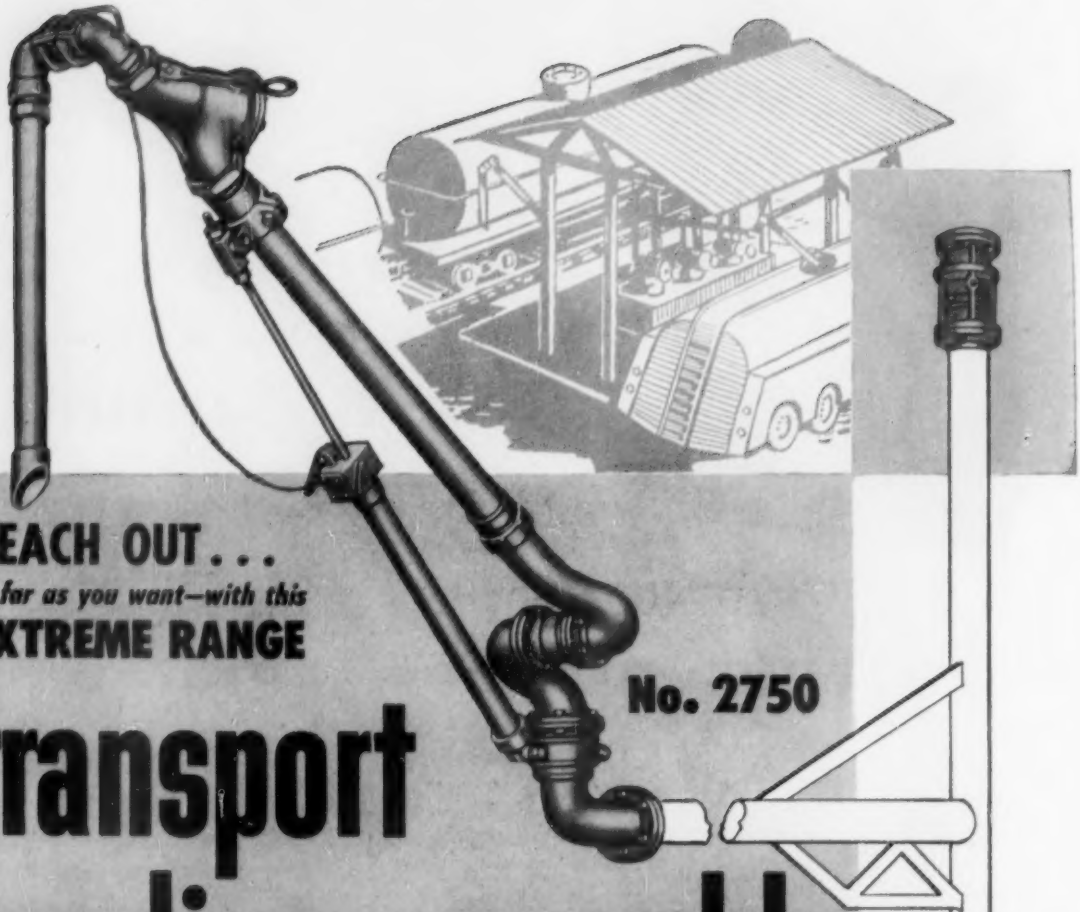
Ask your local Honeywell sales engineer to discuss your flow applications. He's well qualified to give competent consultation . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division,* Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls



REACH OUT . . .
as far as you want—with this
EXTREME RANGE

No. 2750

transport loading assembly

Minimum fill up time . . . no truck respotting . . . at loading racks where OPW's No. 2750 Transport Loading Assemblies are installed. The extreme range, overall compactness, and maneuverability makes the difference . . . provides a really effortless, flexible loading of tank cars and trucks.

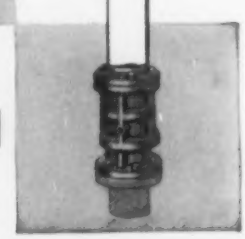
Convenient to operate. No cumbersome counter-weights. Less mass to be started, moved, stopped. Loader controls elevation from truck by remote control cable.

Arm locks in any position, elevates automatically when locking mechanism is released by operator. No valving mechanism, gaskets or piston leathers to wear. Unaffected by changes in temperature or climate.

For more details about this and other outstanding OPW Spring-Balanced and Counter-Balanced Loading Assemblies write for Catalog F-7. No obligation of course.

Sizes: 3", 4"

Riser supported by two bronze or steel straight through flanged double ball bearing swing joints.



Write for Catalog F-7, OGJ

OPW CORPORATION
2731 Colerain Ave.
Cincinnati 25, Ohio

IVERSON'S Newest

NOW, FASTEST SUPPLY SERVICE TO NORTH TEXAS

★ Sherman, Texas

A new IVERSON SUPPLY COMPANY store in Sherman will be good news to the operators in that area who have long been IVERSON customers. From here, we will be able to better serve our friends who depend on us for fulfilling all their needs promptly and efficiently.

Whether or not you are an IVERSON customer, drop in and get acquainted with our store and field personnel at Sherman. They will enjoy meeting you and providing any information that will be of help to you.

CHECK WITH IVERSON, *whatever your requirements*

IVERSON STORES:

NEW MEXICO: Artesia and Farmington.
OKLAHOMA: Oklahoma City, Okmulgee and Tulsa.
TEXAS: Kermit, Odessa, Sherman and Snyder

IVERSON SUPPLY CO. I S C O. OIL WELL SUPPLIES

OFFICES: FT. WORTH, DALLAS & MIDLAND, TEXAS

IVERSON SUPPLY COMPANY

DRILLING-PRODUCTION AND REFINERY EQUIPMENT
P.O. BOX 1439 TULSA 1, OKLA.

OFFICES: DENVER, COLORADO TULSA, OKLAHOMA

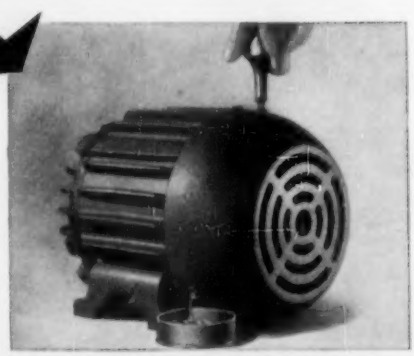
Get Both
bearing features

The bearing is enclosed with a bearing cap held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

fully enclosed and protected
. . . yet
easy to grease

You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.



Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7286.

A-4610

ALLIS-CHALMERS

Pittsburgh's Brilliant White TANKHIDE

Saves Money Two Important Ways . . .

1. **Special pigments and vehicles resist corrosion and weather**
2. **High heat and light reflection reduce waste by evaporation**

LOOKING FOR A TOUGH, long-lasting finish for gasoline and oil storage tanks that will save you money in two important ways? Then choose Pittsburgh's brilliant White TANKHIDE.

TANKHIDE is made with a combination of intensely white titanium pigments and weather-resistant vehicles to give a durable coating that withstands the destructive effects of weather and corrosion. It is designed for thorough one-coat hiding—can be brushed on when spraying is impractical. The quick set and firmness of its film during the drying period prevent collection of dirt and insects—hold damage from rain, scuffing and abrasion at a minimum. TANKHIDE'S gleaming whiteness is maintained throughout its long life by its self-cleaning action.

The ability of TANKHIDE to reflect light and heat holds loss of tank contents caused by evaporation to a minimum.

TANKHIDE is also available in synthetic gray and black as well as in gray and black oil-base finishes that are suitable for either metal or wood surfaces. Pittsburgh also provides a wide variety of high quality finishes for every need in the petroleum industry. Our wide experience in this field often can save you time and money. Write, wire or phone Pittsburgh Plate Glass Company, Industrial Paint Division, 1 Gateway Center, Pittsburgh, Pa.

PPG

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

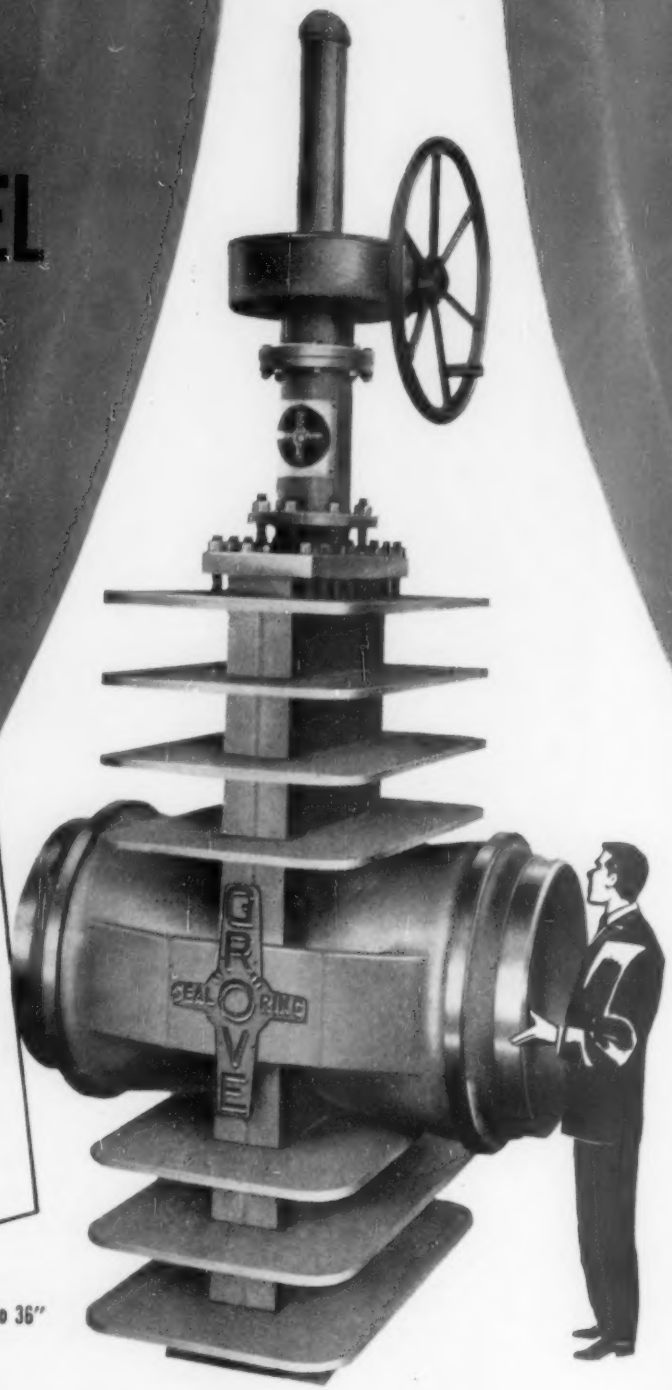
IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

Here it is!

GROVE SEAL-"O"-RING FABRICATED STEEL GATE VALVE

Exclusive Grove fabricated steel body design makes Seal-"O"-Ring gate valve advantages now available through 36" for all pipeline pressures

For the full story on the valve of tomorrow — already proved in use today — contact your Grove representative, or phone, wire or write for details.



Valve sizes from 2" to 36"

503

GROVE SEAL-"O"-RING Gate Valves

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, California
HOUSTON 4 — 1901 Calumet St. • • • • • • • • LOS ANGELES 6 — 1930 W. Olympic Blvd.
ODESSA, TEX. • TULSA, OKLA. • LAFAYETTE, LA. • CHICAGO, ILL. • DENVER, COLO. • In Western Canada: GROVE VALVE LIMITED

GROVE SEAL O RING GROVE SIMPLICITY ACCURACY SAFETY

Shop for more profit at this "GENERAL STORE"

There are two sure ways to save time and money in the field: (1) anticipate the need for supplies before it occurs, and (2) meet that need by getting quality supply items from a single, reliable source. You can do both by stopping at a National Supply Store.

Here, the "general store" atmosphere of friendly, helpful service is combined with selected quality stocks to meet your needs. Take the time to look over these items of quality equipment, operating supplies, hand tools and accessories. The shopping you do in the display areas, shelves and bins will pay dividends in more profitable operations, now and later. If you need an unusual item not in stock, the store personnel will be glad to get it for you.

It pays to ask about new product developments, too. National Supply men will give you the information, as well as outstanding supply service, on new products that can make your operations more profitable.

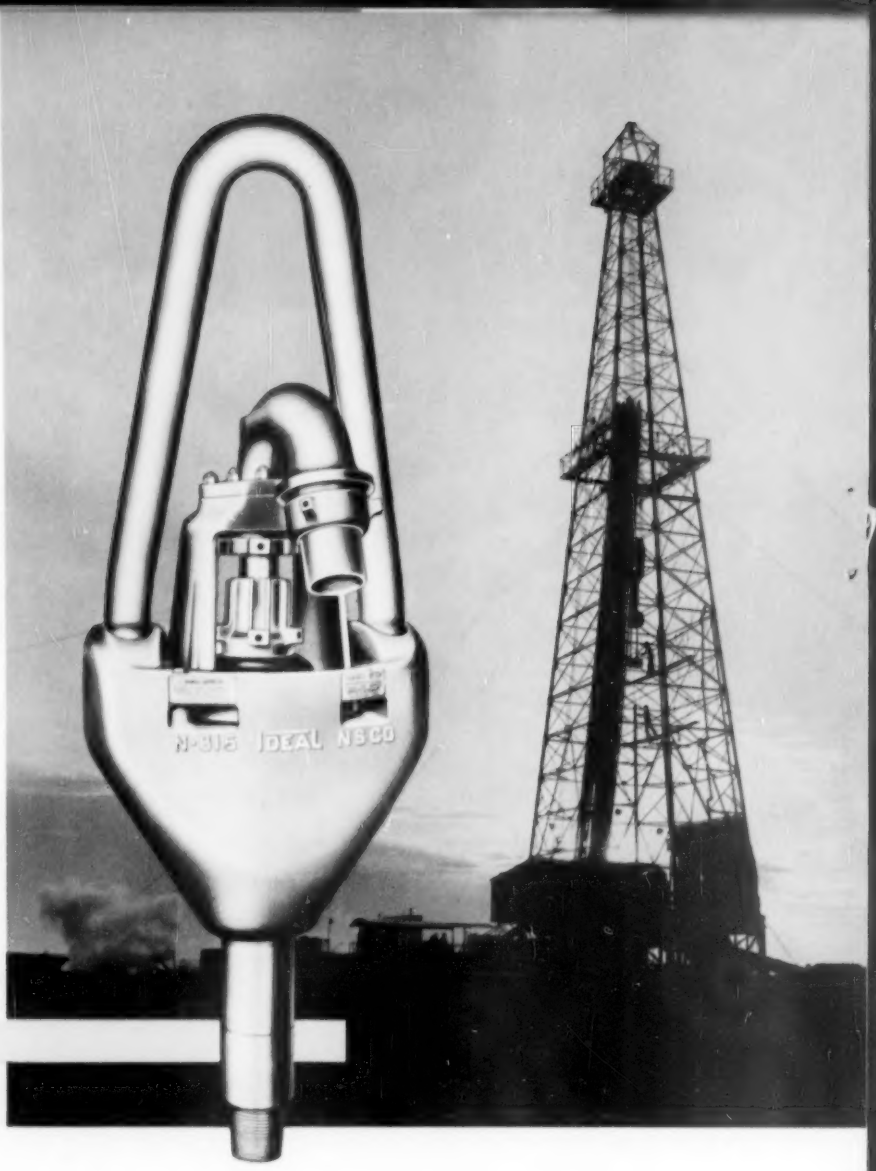
Traditionally and now, a complete line of quality equipment and helpful service have made National Supply the leading "storekeeper to the oil industry." Thousands of satisfied customers who shop for more profit in our 124 stores confirm this reputation.

THE
NATIONAL SUPPLY
COMPANY

Why it costs less to use an

IDEAL®

"TYPE N" SWIVEL:



The simple, compact design of Type N Swivels is characteristic of the built-in safety of products bearing the Ideal trademark. However, this feature is just one of several that insure continuous service at low operating and maintenance costs. Take a close look at these additional reasons why an Ideal Swivel cuts the cost of drilling:

Reduced weight: Complete redesigning has been employed to bring every model of Ideal Swivels down to minimum weight in relation to individual rated capacity. The use of high quality, high-strength components throughout every swivel has reduced both over-all height and weight to greatly facilitate handling.

Lower center of gravity: Centerline of the bail pins on the Type N Ideal Swivels has been raised, thereby lowering center of gravity. This means greater stability in handling, makes connection of swivel "sub" to kelly easier and faster.

Streamlined exterior: The one-piece steel body of the Ideal Type N Swivel is free from any dangerous projections. All bolts, nuts, pins and grease fittings are recessed to assure maximum safety to the derrick crew.

Fast wash pipe replacement: National's exclusive Uniflex Wash Pipe Box assembly is standard on all Type N Swivels. An approved method for packing off the mud, the Uniflex assembly also features quick-acting threads to speed replacement . . . is easily assembled by one man, and can be installed without removing gooseneck or hose connection.

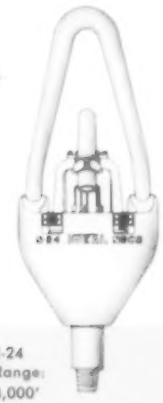
Rapid hose coupling: Also standard in these swivels is the Quick-Seal Hose Connection that speeds make-up of hose joint. Besides eliminating one hose connection member and minimizing mud leakage, the Ideal Quick-Seal Connection features larger, quick-acting threads and sealing elements to withstand rugged use.

For complete details on Ideal Type N Swivels, see your National Supply representative soon. He'll be glad to help you select the one which meets your needs best.

There's an IDEAL "Type N" Swivel for every job—

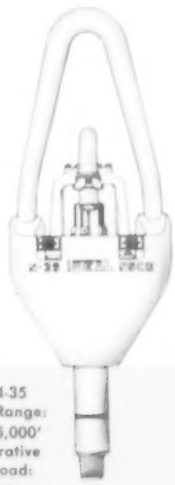
which one can you best use
to reduce your drilling costs?

N-24



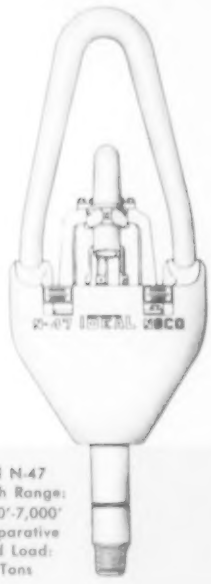
Ideal N-24
Depth Range:
2,000'-4,000'
Comparative
Dead Load:
110 Tons

N-35



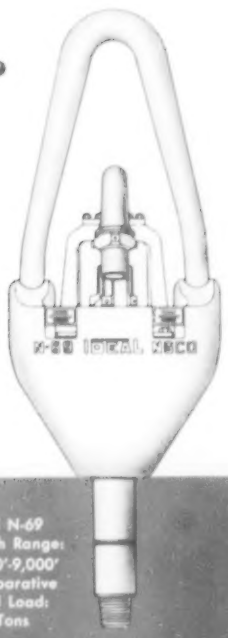
Ideal N-35
Depth Range:
3,000'-5,000'
Comparative
Dead Load:
150 Tons

N-47



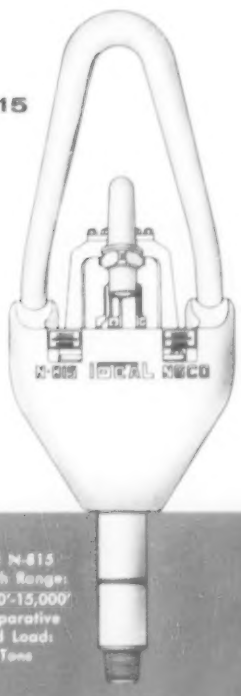
Ideal N-47
Depth Range:
4'000'-7,000'
Comparative
Dead Load:
200 Tons

N-69



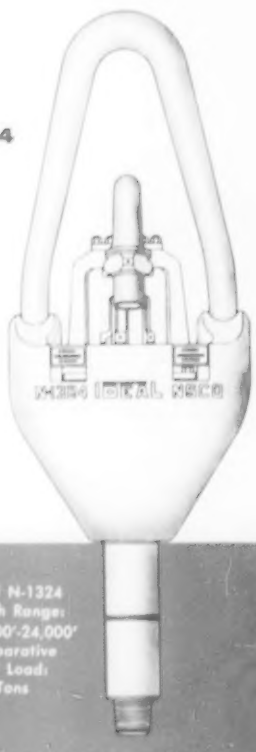
Ideal N-69
Depth Range:
6,000'-9,000'
Comparative
Dead Load:
300 Tons

N-815



Ideal N-815
Depth Range:
8,000'-15,000'
Comparative
Dead Load:
400 Tons

N-1324



Ideal N-1324
Depth Range:
13,000'-24,000'
Comparative
Dead Load:
500 Tons

Looking for a dependable block, too? See the next page...

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N. Y., U. S. A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

You get fast, true running action with

SAFETY-ENGINEERED IDEAL® BLOCKS

If you're losing time and money because of slow or unsafe block action, Ideal Hook Blocks or Traveling Blocks can solve your problems. Every Ideal Block is engineered for safety, built for rugged service and thoroughly field-tested. You can choose from a complete line of Hook Blocks and Traveling Blocks that National has developed for every drilling need, and get the outstanding features shown below:

Ideal Type E

HOOK BLOCK

Designed to effect the greatest possible saving in vertical derrick space, this 200-ton rated block is typical of the Type E line. Ideal Type E Blocks are available in three sizes for 90- to 200-ton loads.

Ideal Type F

TRAVELING BLOCK

Typical of National's Type F series blocks, this 300-ton capacity traveling block is designed to remain stable in operation even under no load. Ideal Type F Blocks are available in two sizes for 300- to 450-ton loads.

Ideal Type F

UNIVERSAL HOOK BLOCK

The new swivel block "universal" pin joint feature in this heavy-duty, 300-ton rated block distinguishes it from rigidly connected hook and block combinations. Ideal Type F Universal Blocks are rated for 300- to 450-ton loads.

Special hook features

- Hook body mounted on tapered roller bearings
- Elevator link supports equipped with positive retaining links
- Automatic-latching hook tongue cannot be accidentally opened
- Spring-actuated 8-position rotation lock
- Grooved hook body facilitates elevator alignment with drill pipe

Traveling block features

- Sheaves independently mounted on tapered roller bearings
- Individual lubrication to each sheave bearing
- All parts securely locked for safety
- Streamlined—all nuts, bolts, pins and fittings recessed
- Short, low stressed pins and shafts

Your National representative will be glad to give you more information about Ideal Hook Blocks, Traveling Blocks and companion Crown Blocks. Ask him soon about the units that can put new speed and safety into your drilling program.

THE NATIONAL SUPPLY COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N. Y., U. S. A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

New Increased Power

INTERNATIONAL TD-18A

Now with 103 Drawbar HP

LOOK AT THAT LOAD as operator applies 103-drawbar hp of new TD-18A. Steering is effortless with new hydraulic finger-tip controls and positive, self-energizing brakes.

NEW **Power . . . New gearing . . . New ruggedness —for greater production**

NEW **Track Frames . . . 300 per cent stronger**

NEW **Finger-Tip Power Steering . . . advanced hydraulic design**

NEW **Operator Compartment . . . comfortable driver's seat —easy-to-reach controls**

NEW **Track Roller Oil Seals . . . 500-hour period between lubrications**

NEW **Positive Self-Energizing Brakes, 13% more effective brake area**

NEW **Appearance . . . sleek grille, heavy fenders, 75-gallon fuel tank. Better visibility . . . control-tower view front and rear**

Here's the crawler tractor with everything contractors need to meet increased competition—increased work-power, increased ease of operation, increased durability:

The improved INTERNATIONAL TD-18A, now with 103-drawbar horsepower at 24,300 lbs. maximum drawbar pull in first gear at rated rpm.

Double check all these great new TD-18A features—right here on this page—on your job where you can take over the controls and appraise their value in extra work done for lower cost. Your INTERNATIONAL Industrial Power Distributor will arrange your own personal shake-down test of the TD-18A any time you say.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL®
INDUSTRIAL POWER

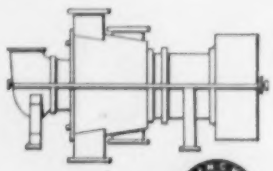
MAKES EVERY LOAD A PAYLOAD

FACTS on Westinghouse 5000-hp gas turbines . . .

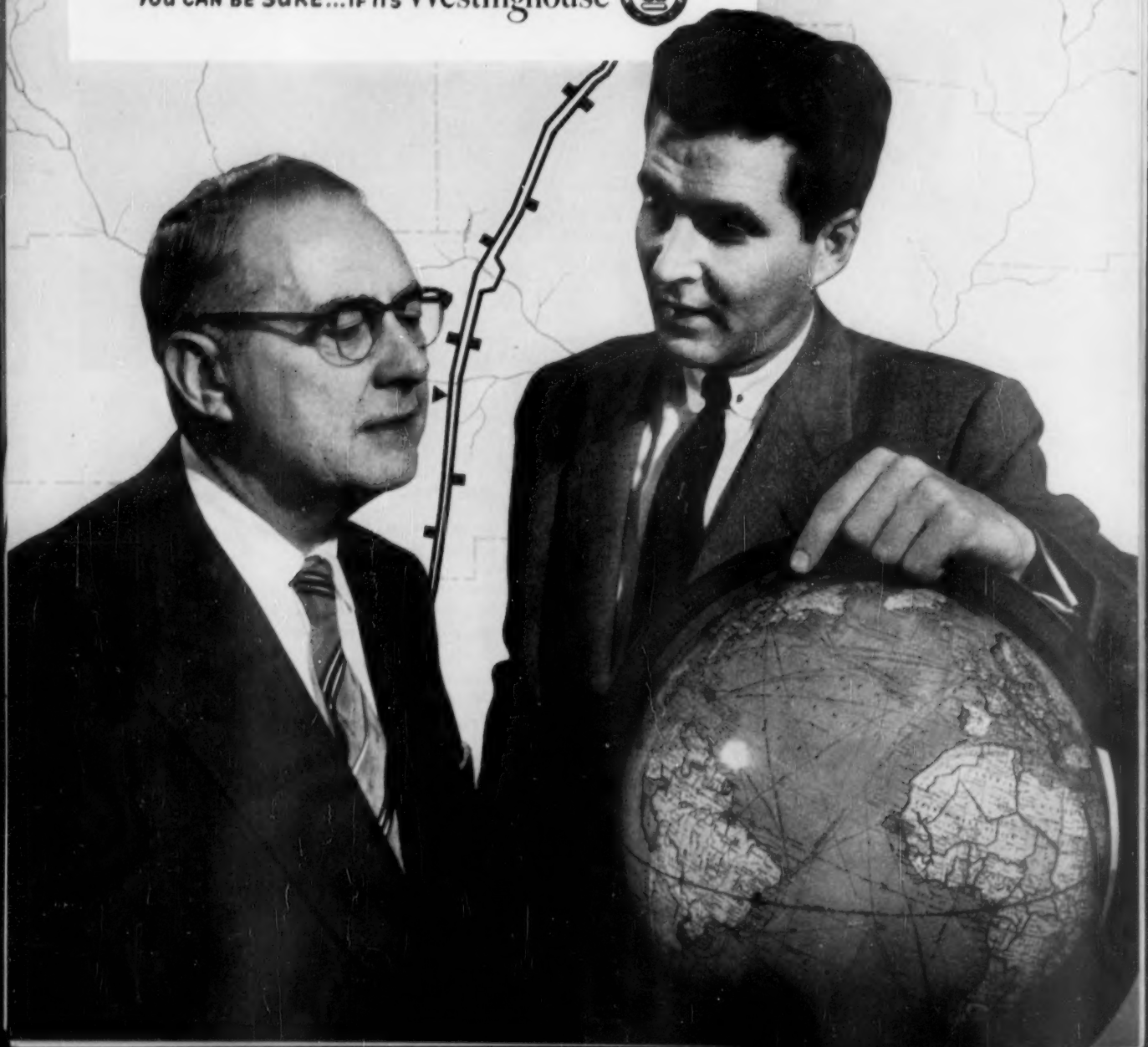
Backed by world-wide service

Wherever in the world a pipeline begins, goes or ends, there's a Westinghouse field engineer available to render competent engineering service. • This is based on 60 years' Westinghouse pipeline experience. • Field engineers are backed up by headquarters specialists who stand ready to visit locations anywhere and make detailed studies. • Every Westinghouse gas turbine carries with it this extra assurance of complete satisfaction.

For more information, see your Westinghouse sales engineer, THE MAN WITH THE FACTS, or write for booklet B-5859. Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa. J-50586



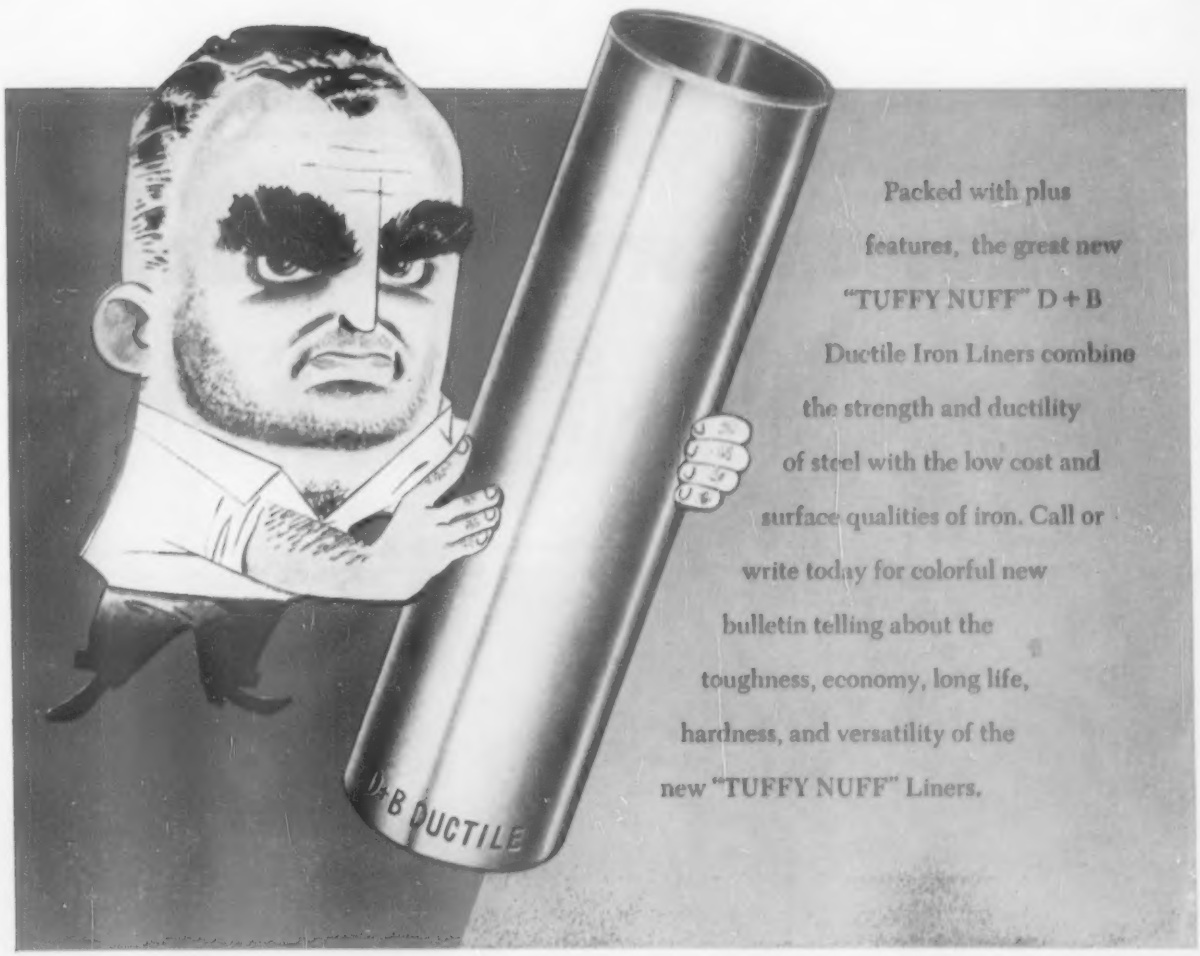
YOU CAN BE SURE... IF IT'S Westinghouse



NOW!

you can increase your LINER LIFE 2 to 5 times with **"Tuffy Nuff"** the amazing new D+B DUCTILE IRON LINER

—and at ***no premium price***



Packed with plus features, the great new "TUFFY NUFF" D+B Ductile Iron Liners combine the strength and ductility of steel with the low cost and surface qualities of iron. Call or write today for colorful new bulletin telling about the toughness, economy, long life, hardness, and versatility of the new "TUFFY NUFF" Liners.

D+B EMSCO

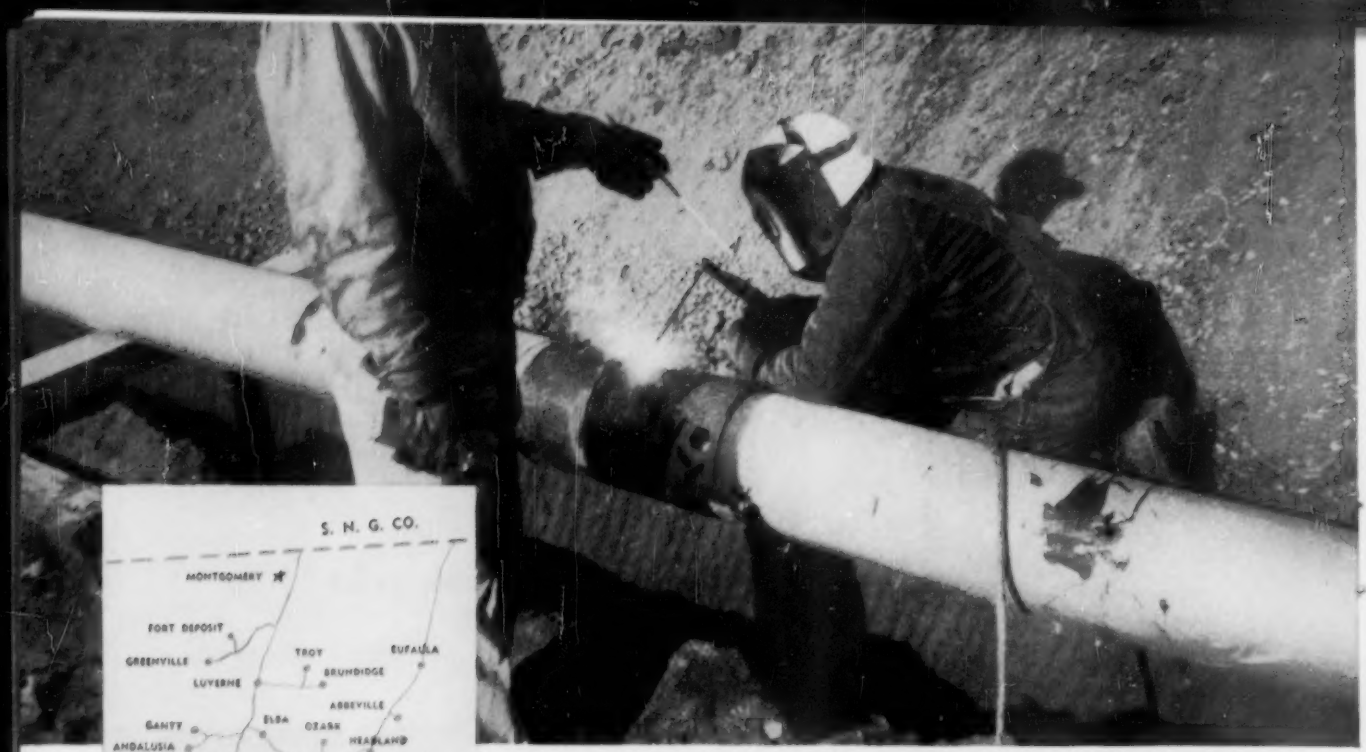
REG. U.S. PAT. OFF.

D+B DIVISION

EMSCO MANUFACTURING COMPANY

HOUSTON, TEXAS • LOS ANGELES, CALIF. • GARLAND, TEXAS

Mid-Continent Distributor: CONTINENTAL SUPPLY COMPANY, Dallas, Texas
Canadian Distributor: CONTINENTAL SUPPLY CO., LTD., Calgary, Alberta
Export Distributor: CONTINENTAL SUPPLY CO., INC., New York, New York



A finish welder at work on a joint of 10¾" O.D. National Seamless.

ENTIRE SOUTHEAST ALABAMA GAS DISTRICT

22,000 tons of NATIONAL

Coated and wrapped pipe being laid in preparation for back filling.

Bending and welding 10¾" O.D. National Seamless for a creek crossing.

SERVED BY SEAMLESS Line Pipe

Welders and wrappers at work on a portion of the 10¾" O.D. main line.

THE Southeast Alabama Gas District, consisting of 24 communities, will be served by a 330-mile "U" shaped system of USS National Seamless Line Pipe, designed by Goodwin Engineers, Inc., of Birmingham, Alabama.

The new main line ties into Southern Natural Gas Company's line approximately 12 miles south of Montgomery. It runs south to Brantley, then turns eastward at Andalusia and continues through Enterprise to Dothan. From Dothan it runs north and ties back into Southern Natural's line a few miles south of Opelika, Alabama.

The total 22,000 tons of pipe were made up of 6⅝" O.D., 8⅝" O.D. and 10¾" O.D. National Seamless. It was transported to the installation site in Alabama by both barge and rail from plants in Ohio and Pennsylvania.

USS National Seamless Pipe is chosen consistently for the most challenging of cross-country pipeline jobs. Engineers know from past successes, like the "Big Inch" and the Straits of Mackinac crossing, that the best line installations are accomplished with National Seamless. Its high strength, complete uniformity, and a flexibility that lets it absorb ground pressures and bending stresses keep it trouble-free, even under the most punishing conditions.

IN GAS LINES TOO . . . SEAMLESS DOES IT BETTER

NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

National Seamless Pipe and Tubes

SEAMLESS WITHOUT WELDS

UNITED STATES STEEL

PARKERSBURG

LARGE SINGLE TUBE HORIZONTAL SEPARATORS

give you the OPTIMUM in SEPARATING EFFICIENCY for these reasons . . .

1. Greater gas flow area (20% greater than two-tube designs).
2. Greater interface area (20% greater than two-tube designs).
3. Longer retention time (because the large single tube retains a larger volume of oil than two-tube designs).
4. Automatic Control (assured by the exclusive No-Bleed Level Controller).

PLUS these operating advantages . . .

1. Easier to clean (only one tube and it's open all along the bottom for unobstructed flushing).
2. Less freezing trouble (liquid, both water and gas, is always close to the stream of warm gas . . . always 12° to 15° warmer than in a two-tube design).
3. Easily unitized (standard units can be assembled side-by-side or over-and-under for two-stage separation).

Only Parkersburg Large Single Tube Horizontal Separators have these basic principles of more efficient separation PLUS these proven operating advantages. Before you buy any separator, talk over these advantages with your Parkersburg Representative.

Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

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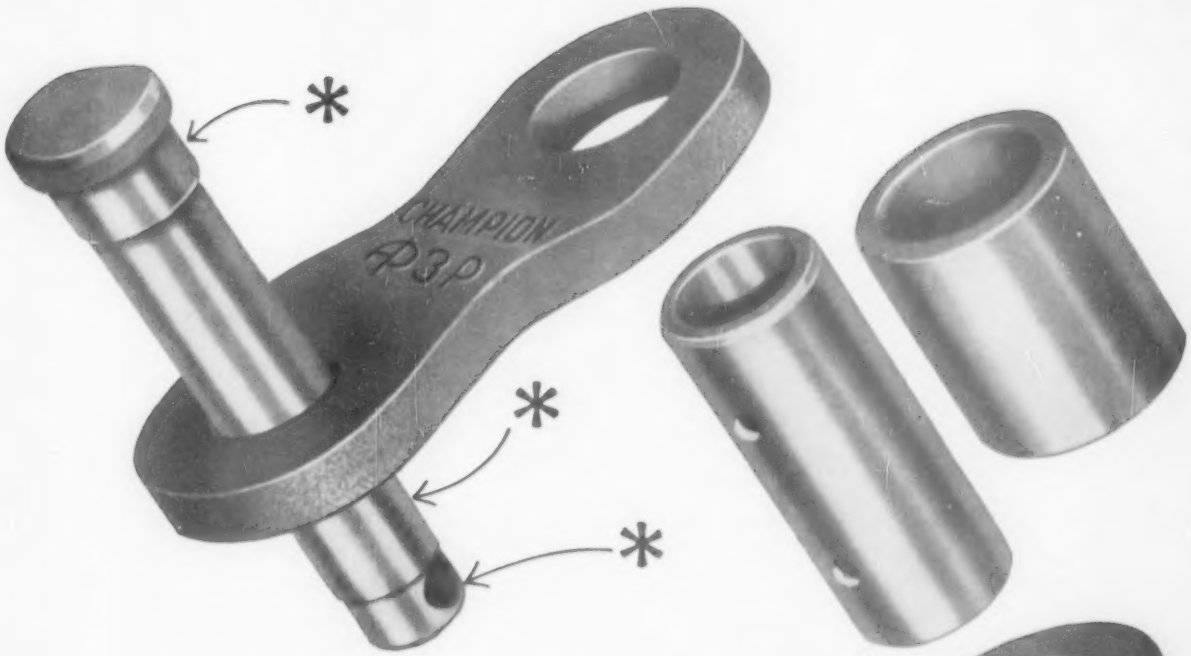


No special glasses needed for our 3D*

You can easily see the advantages of the 3-D ... 3-Diameter Pin...used in Rex A.P.I. Oil Field Chains. Three individual diameters... *one* under the pin head...*two* on the bushing bearing area...*three* on the cotter end... assure fast, easy field assembly and disassembly. It is necessary only to drive the pin the thickness of a single sidebar. No need for heavy battering with sledge and drift pins. Yet, there is no sacrifice in strength, bearing area or pin life. The Rex 3-D Pin is but one of the many advantages that make Rex A.P.I. Chains "the favorites in the fields." For the complete story, see your supply store or write Chain Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

District Sales Offices and Distributors in all principal cities

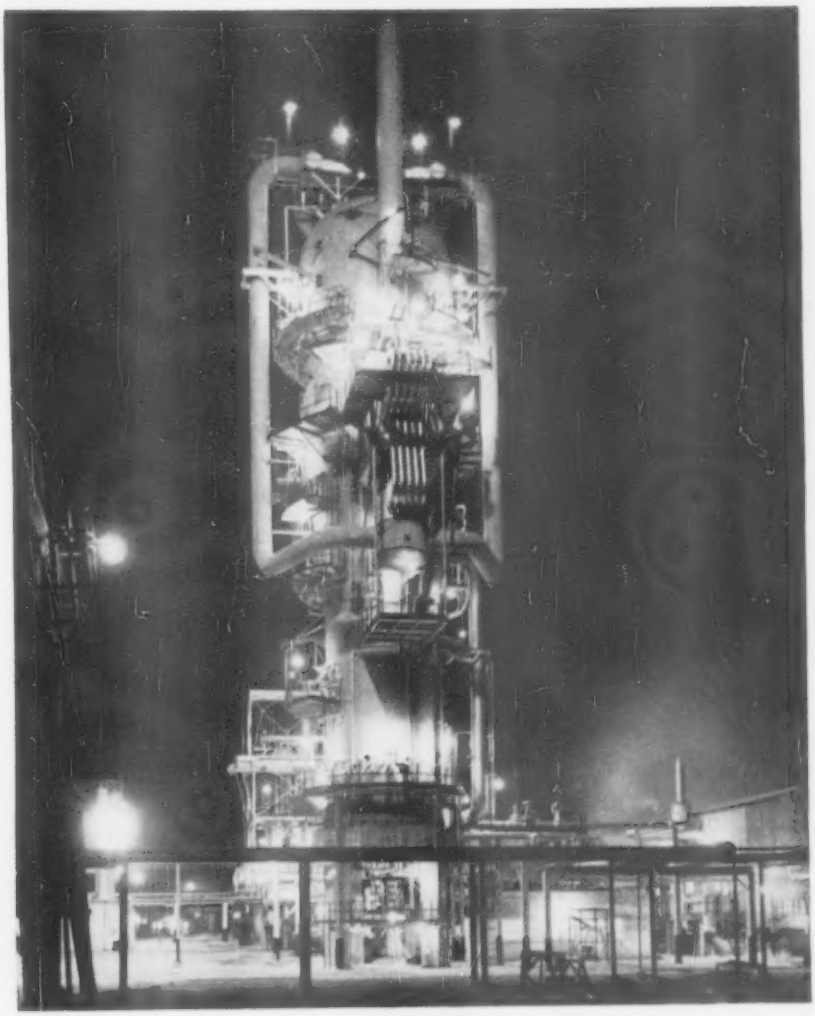
FIRST

IN CAT CRACKING

With over 30 per cent of all crude today eventually becoming cat cracker feed, cat cracker design is increasingly important to refiners. The superiority of the *Fluid* Cat Cracking design is well-established by the fact that 70 per cent of cat cracking capacity in the free world is the fluid design. The M. W. Kellogg Company has engineered or erected more than half of this fluid capacity.

M. W. Kellogg has been in the forefront of Fluid Catalytic Cracking from the beginning. Starting early with continuing studies of catalysts, it worked closely with the industry in engineering the fluid principle. M. W. Kellogg's contribution in mechanical engineering made it possible to design units of capacities large enough to meet accelerated demands for higher octanes since World War II. Its long experience in constructing oil refineries enabled M. W. Kellogg to undertake the erecting of these initial units, and the even larger ones in operation today, with full confidence that they would be on stream in minimum time.

An M. W. Kellogg Fluid Catalytic Cracking unit is your guarantee of many predetermined requirements, including throughput capacity, product quality and quantity, utility cost, catalyst loss, and coke-burning capacity. From its experience in engineering and erecting many side-by-side units, M. W. Kellogg originated



The distinctive vertical construction of M. W. Kellogg's Orthoflow Fluid Catalytic Cracker—a logical development from the side-by-side model—is becoming more and more familiar on refinery skylines. Orthoflow units completed or under construction since 1951 already represent a total throughput of over 290,000 BPD.

the straight-line Orthoflow* design—which offers many extra economic advantages.

A full-color, 13-minute movie, showing how the Orthoflow works, is now being booked for showings after July 1. Return coupon for particulars and to obtain a copy of our No. 2, 1955 Kelloggram which illustrates a recent Orthoflow installation.

Refinery Process Division

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225 Broadway, New York 7, N. Y.

☐ Send available dates for showing of your new Orthoflow film.

My preference after July 1 is (1) _____ *(2)* _____

☐ Send Kelloggram illustrating recent Orthoflow installation.

Name _____ *(Title if any)*

Company _____

Address _____

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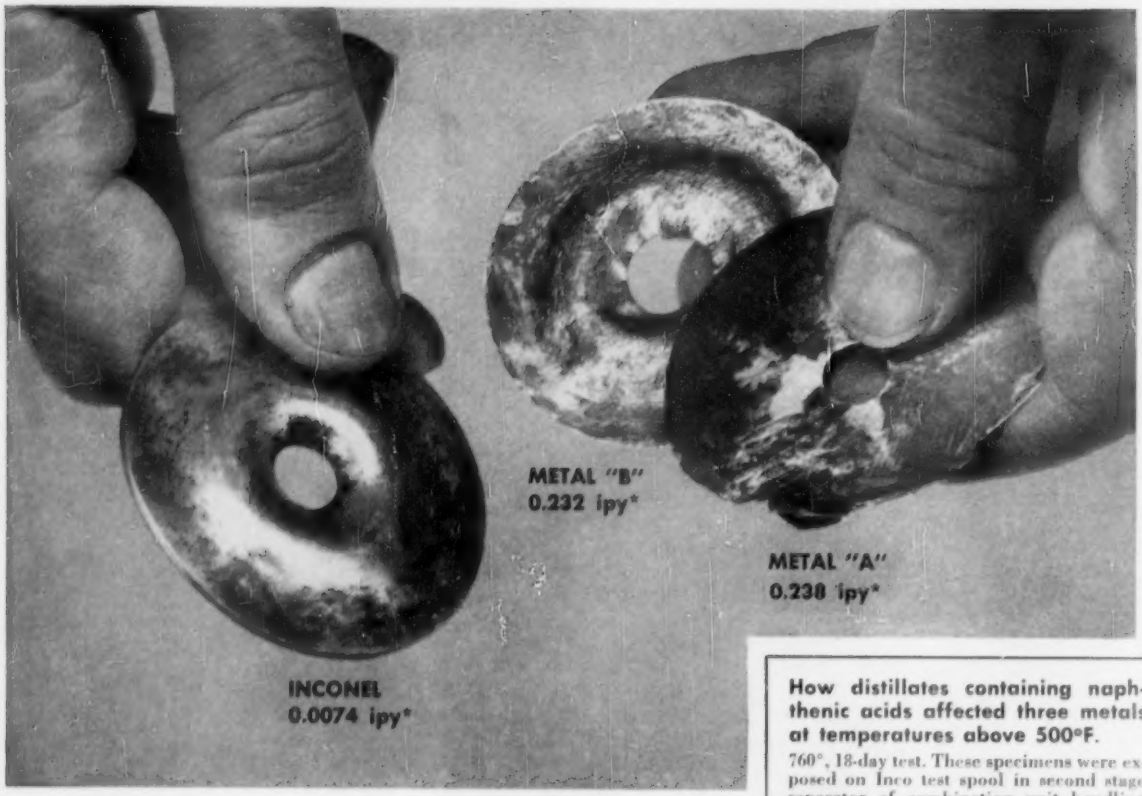


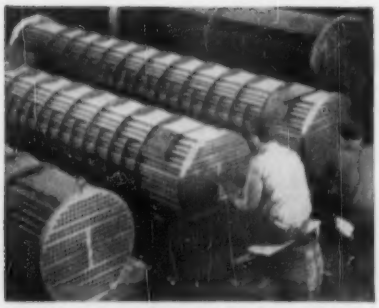
How distillates containing naphthenic acids affected three metals at temperatures above 500°F.

760°, 18-day test. These specimens were exposed on Inco test spool in second stage separator of combination unit handling cracked petroleum gas oil from Monaca crude (naphthenic base). Sulfur, 1.27%.

* ipy — inches penetration per year of continuous exposure

"Even above 500° F," test spools indicated,

"Inconel can prevent naphthenic acid corrosion"



How heat exchangers were made

1085 cold drawn seamless Inconel tubes were inserted into Inconel tube sheets 30½ in. dia., 2-1/16 in. thick, then welded. Strong, tough Inconel, like Monel and Nickel, is readily fabricated and welded. No after treatment needed.

...Now, 13 trouble-free years of service from heat exchanger tubes prove it.

Even above 500°F, Inconel stands up under naphthenic acid corrosion. This was first shown years ago, when a certain South American refinery made "on stream" tests with specimens of several metals.

Because of these tests, the engineers specified Inconel for tubes and tube sheets in three heat exchangers. Thirteen years later, the equipment was still going strong.

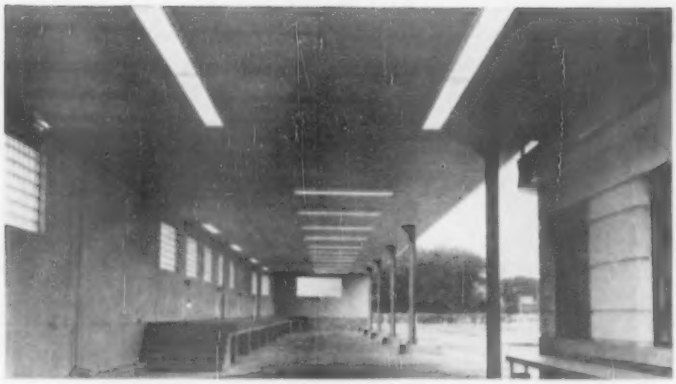
Experience in other installations is comparable. In this application, Inconel not only resists naphthenic acids, but provides good resistance to sulfur attack and oxidation as well.

Another important reason why Inconel is often employed for heat exchanger tubes is the fact that it is highly resistant to stress-corrosion cracking in sea water and other chloride-containing waters. It can thus be used to resist both product- and water-side corrosion.

Are you having trouble with heat exchanger corrosion? Maybe, as in this case, Inco's Corrosion Engineers can help you find the metal that will handle it. Just write details.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Inconel... an INCO Nickel Alloy



Moisture-resistant. K&M Apac sheets are used on the ceiling of this toll entrance and custom office inspection enclosure at the Port Huron, Michigan, Blue Water International Bridge. The moisture in the air at the bridge won't harm them.

You'll be wise to choose

K&M APAC

Asbestos-Cement Sheets

•

Interiors—Exteriors

Remarkable economy!

Temperature, humidity safeguards. Walls of K&M Apac sheets give dependable aid to a cigar manufacturer in an important process—where temperature and humidity are accurately controlled.

All-purpose sheets. This photo shows K&M Apac sheets being applied on a building where they are used for both outside and inside walls as well as for ceilings.

You'll find a thousand and one uses for these flat asbestos-cement sheets: as an interior and exterior siding, office panelling, plant and office ceilings, machine shop sheathing, stock room sidewalls, basement partitions, linings for elevator casings. Use them almost everywhere, inside and outside.

Built to last. K&M Apac sheets are made of two practically indestructible materials, asbestos fiber and portland cement. They won't burn, rot, or corrode. And they never need protective paint.

Look over the illustrations. See a few of the many places where Apac sheets are applied. Then contact your K&M distributor, and ask him to tell you more about low-cost K&M Apac sheets. Informative folders also available on request. Address inquiries to our headquarters in Ambler, Pa.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M best in asbestos®

The measurable advantages of Ross specially engineered exchangers

1 Thirty-five years of accumulated engineering experience qualify Kewanee-Ross to solve *your* heat exchanger problems readily, no matter how highly specialized they are.

2 Comprehensive standardization makes available a large selection of flanges, shell and floating head covers, tube sheets, tube layouts, shell and channel sizes and other components in a wide range of working pressure to meet most requirements.

3 Capacity for special exchanger production has been measurably increased with the addition of another large plant at Kewanee, Illinois. Favorable delivery promises can be made — *and kept.*

Why not arrange for consultation with the Ross exchanger representative nearest you? You will find him both competent and cooperative.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1419 WEST AVENUE • BUFFALO 13, N. Y.
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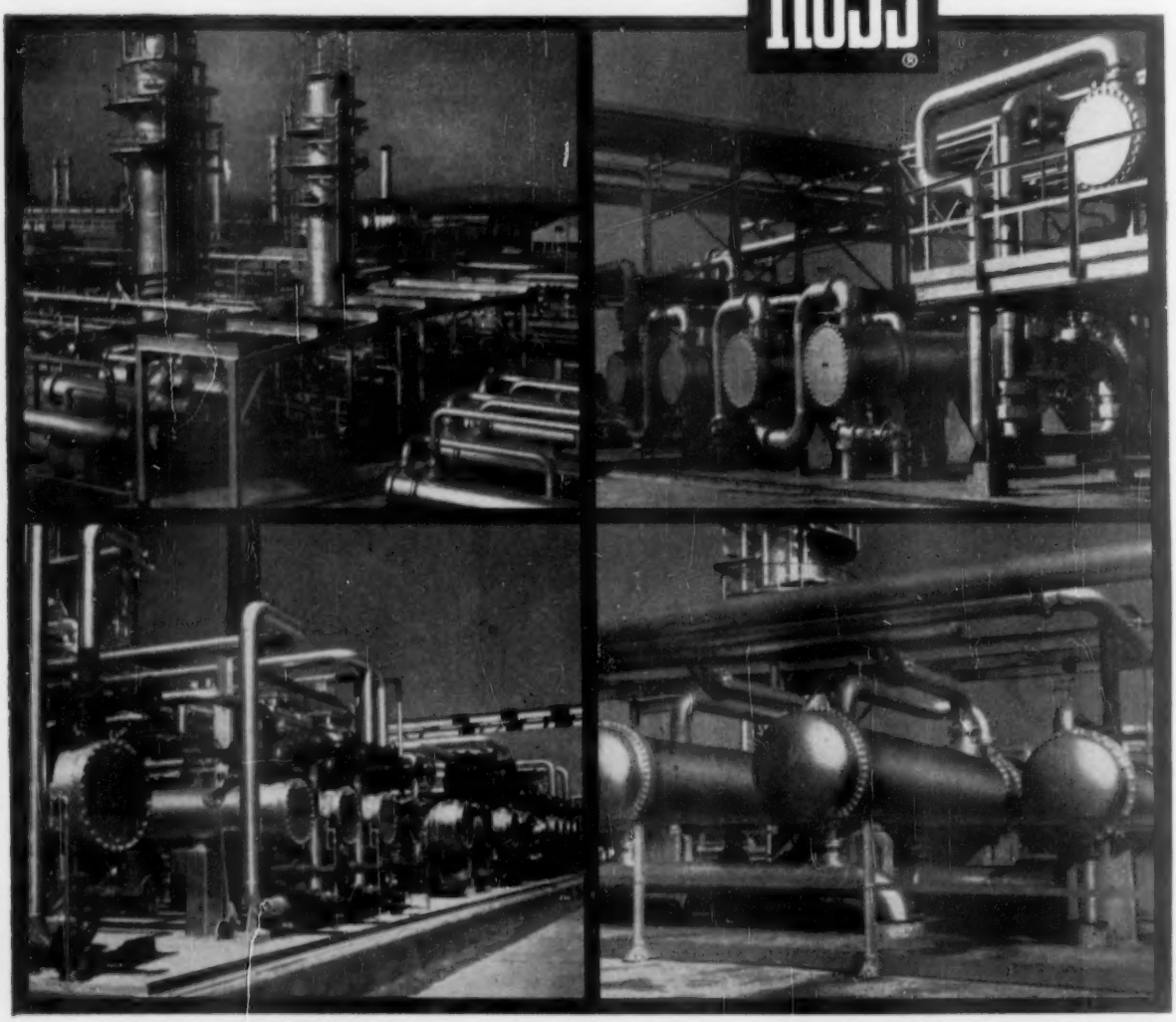

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USE AXELSON FROM TOP TO BOTTOM

To hold that production

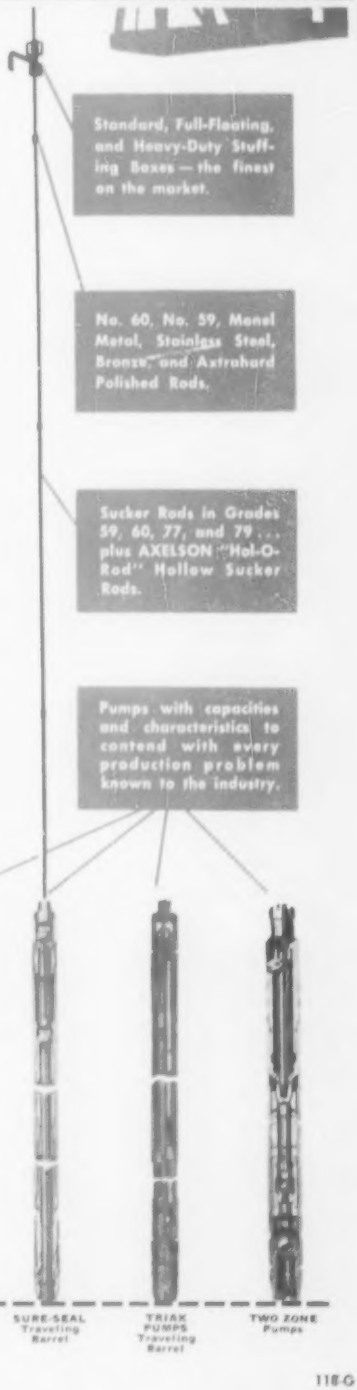
There is an old saying about no chain being stronger than its weakest link . . . and it's true.

Nowhere, from polished rod to bottom-hole pump, is there a weak link in a well using the right Axelson equipment. You can HOLD that PRODUCTION to the maximum with Axelson.

There is another old adage about experience being the best teacher . . . and it's true.

AXELSON HAS MADE PRODUCTION EQUIPMENT SINCE 1892, and THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY BORN OF TECHNICAL EXPERIENCE.

Tolerate no weak links in your production chain! Confer now with men who understand Axelson teamwork — call your J&L store.


Standard, Full-Floating, and Heavy-Duty Stuffing Boxes — the finest on the market.
No. 60, No. 59, Monel Metal, Stainless Steel, Bronze, and Axtrahard Polished Rods.
Sucker Rods in Grades 59, 60, 77, and 79 . . . plus AXELSON "Hol-O-Rod" Hollow Sucker Rods.
Pumps with capacities and characteristics to contend with every production problem known to the industry.
DEEPWELL PLUNGER PUMPS Rod Liner Type Traveling Barrel
SURE-SEAL Traveling Barrel
TRIAX PUMPS Traveling Barrel
TWO ZONE Pumps

Never junk an Axelson Pump. J&L has a Pump Repair Shop near your production, fully equipped and with parts in stock.

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Jones & Laughlin STEEL CORPORATION

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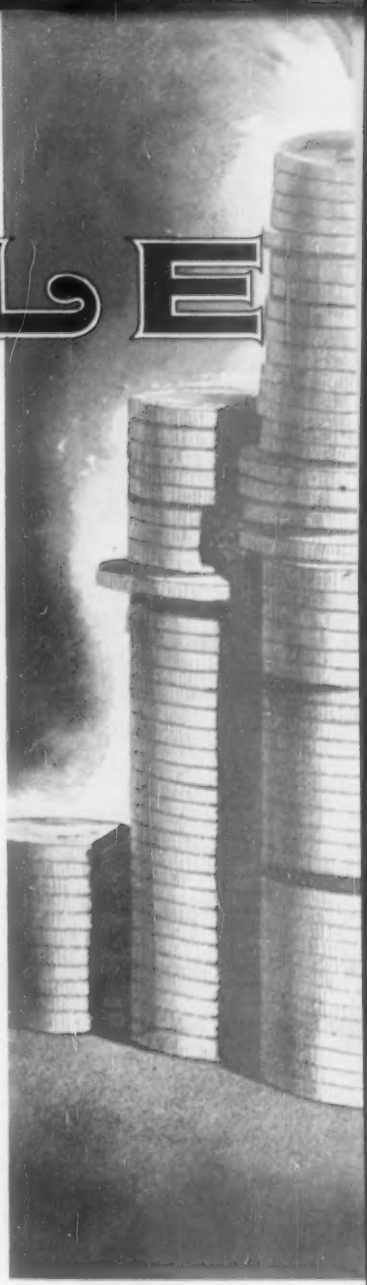
118-G

GAMBLE



THE GAMBLERS of the great gambling casinos of the world are pikers compared to these four players. They gamble against odds that make the odds of Reno, Las Vegas, and Monte Carlo pale into insignificance by comparison.

But no gamblers ever try harder to take the gamble out of their work than these four players. Their odds are the vagaries of nature. Their skill in meeting the odds depends on science, engineering, invention. P.E.S.A.'s nine thousand engineers and the engineers of their great customer, the oil-producing industry, work around the clock to reduce these odds.

These four players are:

P.E.S.A. Manufacturers venturing their capital to make better tools and equipment to stand the extreme pressures, abrasive cutting, shock, and mounting temperatures necessary to keep the wells going to three-mile depth and beyond.

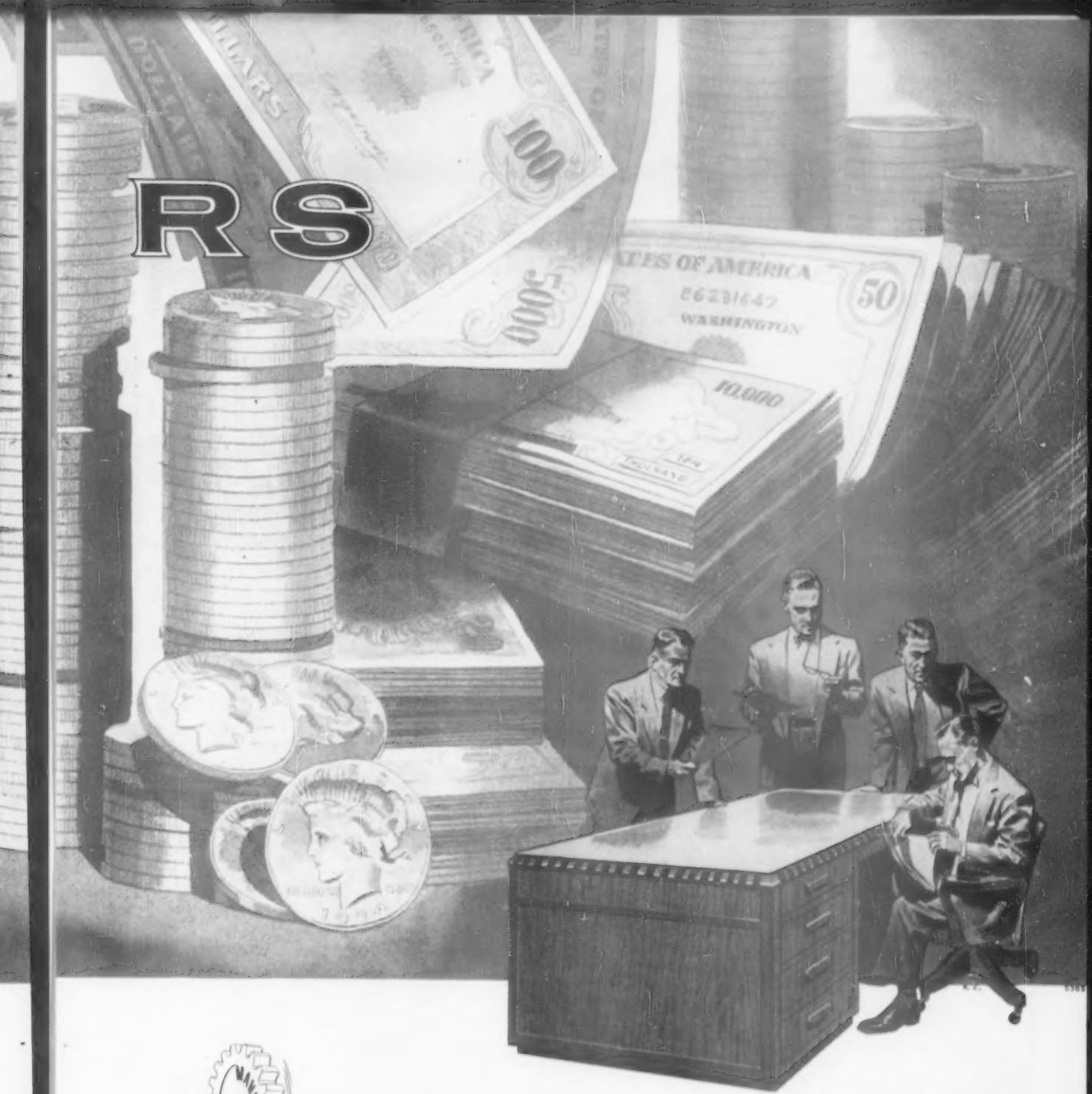
P.E.S.A. Supply Companies venturing their capital to assure oil operators getting ALL the equipment necessary for carrying on oil field operations *when* they want it and *where* they want it.

P.E.S.A. Service Companies venturing their capital in order to carry on expensive basic research necessary to solve the highly technical problems connected with much oil field service; in order to develop and construct the equipment necessary to adapt theory to practice; in order to provide the highly skilled scientists, engineers and technicians necessary to perform the services and to lend their know-how, integrity, and sincerity of purpose, to help analyze well problems and recommend effective, economical solutions.

Oil Companies venturing their capital to obtain oil leases; to apply geology and geophysics to finding favorable formations; to spending great sums of money to find if oil-bearing formations exist, and then to provide the large amount of money necessary to bring the oil out of the ground and transport it to the refineries.

• • •

There are no greater gamblers than the intrepid, risk-taking pioneers who have developed the oil industry into one of the world's greatest and most important businesses. They take risks, but they are calculated risks based on all the scientific knowledge that brilliant men can bring to bear on problems connected with exploring and operating in the depths of the earth. The depletion allowance is recognition of this risk and is a necessary incentive. The aggressive venturism of hardy men also finds its reward in being able to operate under the American free-enterprise system. That's the secret of America's greatness.



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P.E.S.A.

Petroleum Equipment
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Composed of: manufacturers whose plants make the finest precision equipment . . . *supply stores* who add two other ingredients of value — where you want it — when you want it . . . *service companies* who make available to their customers the practical results of the theoretical research of some of the most brilliant scientific and technical men in the world.

AVAILABLE JOHNSTON by AL CAPP

C'MON IN, YO' BIG, MANLY, TANTALIZIN' JOHNSTON BOYS !!
CAINT!- WE ALREADY GOT A THRILLING DATE.
-NAMELY TO BE READY TO TEST THAT NEW WELL BY THE TIME THE PIPE IS OUTA TH' HOLE
KIN YO' WORK THAT FAST AN' STILL BE ACCURATE ?
NATCHERLY!! -FIRST TIME WE TRY!!
-THEN COME BACK WHEN YO' GITS DONE, AN WE'LL TRY T'SET SOME NEW RECORDS!!
US JOHNSTONS ALREADY HAS TH' RECORD!
WE RAN TH' WORLD'S DEEPEST DRILL STEM TEST!!
Al Capp

C-545. Copr. Capp Enterprises 1954

JOHNSTON TESTERS

first in drill stem testing

HOUSTON, TEXAS

LOS ANGELES, CALIF. • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON

Blanketed Base Pans and Automatic Sentries Push Service Dates Apart

Service dates skip months instead of days where operators have Minneapolis-Moline long-run oil field engines. MM exclusive water-jacket base pan with large built-in filters keep engine and lube oil at constant temperature under any load or weather condition.

Automatic control of crankcase temperature prevents sludging and enables more effective filtering. The high efficiency of MM exclusive vacuum crankcase ventilation is obtained by blanketing the base pan with engine water. This holds crankcase vapor above the dew point so that (instead of condensing and forming sludge) it is withdrawn.

Added advantages of MM long-run design are extra large permanently lubricated bearings, sealed pressure cooling with water by-pass and thermostat control, built-in oil-flow controllers and automatic sentries —safety cutouts that prevent damage in case of low oil pressure or excessive water temperature.

For complete facts and specifications on lowest cost and most dependable power in the oil fields phone

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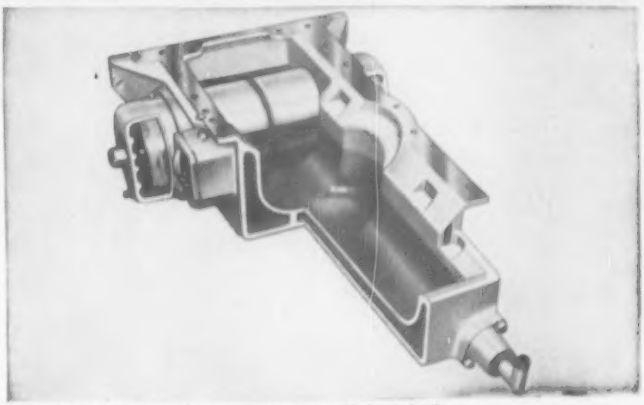
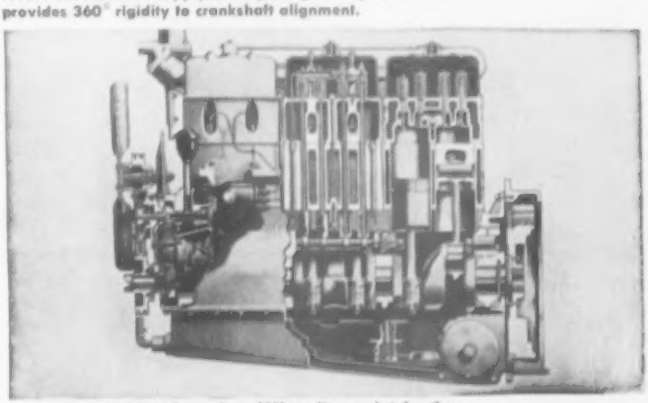
Twenty Years of Oil Field Engine Application at Your Service

INDUSTRIAL DIVISION

MINNEAPOLIS-MOLINE
MINNEAPOLIS 1, MINNESOTA

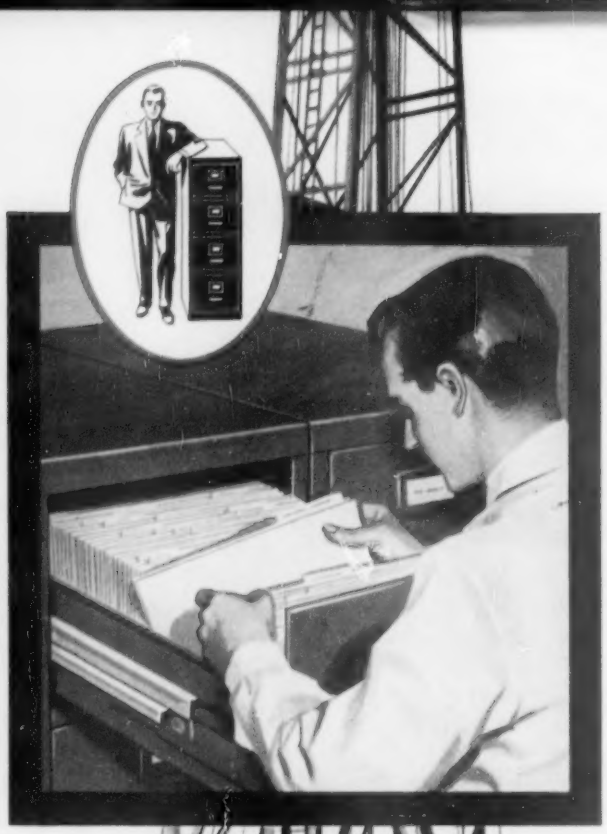


Water-jacketed heat exchanger base pans with large built-in filters provide automatic thermostatic control of lube oil temperature. Oil flow controller maintains constant oil level from reservoir supply. Heavy flange on flywheel and provides 360° rigidity to crankshaft alignment.



Engine cross-section shows how MM cooling maintains the entire engine at a constant temperature. Variation maximum is 4° to 5°. Automatic thermostatic control and by-pass system act as heater or cooler—engine runs at constant temperature under all operating conditions.

How does a **BAROID ENGINEER** *know the best mud program for your well?*



The answer lies in the remarkable data he receives from Baroid's engineering staff and skilfully applies to your particular well.

From more than three-quarters of a million test reports made by Baroid engineers, key facts have been sifted and filed about muds in every region, every field, every formation, every depth. This includes reports on wells in your particular area.

No other mud supplier can have so complete a file because Baroid is the most experienced mud firm.

This information, interpreted and applied by your Baroid engineer, assures you a successful mud program. That is why men who specify mud specify Baroid products and prefer a Baroid field engineer.

BAROID P. O. Box 1675, Houston 1, Texas

Please send me the Trouble-Shooting Charts compiled from data in your field report files.

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Somebody is about to get the best service in the field

Here's a picture of a situation that happens every day. A telephone call from a user of O-C-T Equipment . . . and the O-C-T Service Organization gets in high gear.

As a result of its continuous expansion program during the past six years, Oil Center Tool Company now has the largest service organization in the field to help you set and service wellhead assemblies.

At present, you will find O-C-T service within a stone's throw of your operations throughout Texas, Louisiana, Oklahoma, Mississippi, New Mexico, the Rocky Mountain area, Canada and Venezuela.

There comes a time on every job when good service from your equipment supplier can save you money. And you'll be dollars ahead when you switch . . . and standardize . . . on dependable O-C-T equipment. It's available through more than 700 supply store points.

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Export Representatives: Sterling Areas—Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

ATLAS PROCESSING COMPANY *at* Shreveport, Louisiana, has recently placed in operation this Hudson-Built benzene recovery plant, the first to recover substantial quantities of natural benzene from liquid hydrocarbons extracted from natural gas. Over 98% of the benzene present in motor fuel base stocks produced in gas processing plants in the Carthage gas distillate field of East Texas is extracted in this unit. The benzene is nitration grade, having a purity of over 99.6%. Hudson is proud of its part in implementing the concept of the Atlas management in this pioneering operation.

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ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

Double Your Drying Capacity!

Use Sovabead in your dehydrator!

- It nearly doubles dehydrator efficiency.
- Maintains efficiency at temperatures as high as 120°F.
- Provides longer desiccant bed life.
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MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.
Formerly Socony-Vacuum Oil Company, Inc.

They Say—

Big Importers Should Bow: I.P.A.A.

"On the basis of this analysis (of the probability of voluntary reduction of imports by the 'big five' oil importers), none of the five principal importing companies has yet taken the necessary action which would lead to an adjustment of total imports to recommended levels. Such action is long overdue. Continued failure to act will constitute not only an invitation, but a necessity, for the Government to implement the policy so clearly defined by both Congress and the executive branch of Government."

Russell B. Brown, general counsel of the Independent Petroleum Association of America, in a statement favoring cutbacks by major importers.

Success Seen for Louisiana Oil Show

Dear Sir:

All indications point to a complete sellout and an overwhelming popular response to the first biennial production of "LAGCOE" — the Louisiana Gulf Coast Oil Exposition—set for Lafayette, La., October 13 through 16.

More than 175 exhibitors, including many of the nation's leading oil production, selling, and service firms, have already reserved space for Blackham Coliseum, surrounding outside areas, and buildings. The entire Lafayette area community is "pushing" the nonprofit oil show . . . Mrs. Gloria Knox of Sinclair Oil Co., only woman "landman" in the nation, is entertainment chairman. President is R. D. (Dobbin) Cloninger, independent oil agent . . .

Alan B. Citron
Promotion Chairman
Room 20
Sonnier Building
Lafayette, La.

Douglas Champions Gas Consumers?

"The heart of U. S. Senator Douglas of Illinois, one of the principal opponents of pending legislation to exempt the production of natural gas from federal price regulation, bleeds for the consumers of gas—but in terms that have little resemblance to logic.

"The 20 million residential-gas consumers in Northern and Eastern states, he says, are 'captive' consumers. In recent years they have attached themselves to the end of pipelines from the Southwestern gas-producing states and there is no escape. They cannot, Senator Douglas contends, switch to another

You Only Need a Hand To Torque Properly!

NO NEED TO LOOK OR LISTEN WITH THE SUPER-FAST PROTO TORQUER

NEW Model F Torquers Meet Military Specs

Design variations from standard Torquers to meet U.S. Air Force Specifications are found in the New Model F Torquers. Capacities from 150 to 4800 in.-lbs., with ¼" to ¾" drives.

Just set the micrometer-type handle—the wrench releases *automatically* at the exact torque you want. No troublesome clicks, dials, scales or pointers. It's fast, accurate, rugged! 27 models, ranging from 5 to 4800 in.-lbs. and 5 to 500 ft.-lbs.—with plain or ratchet head. Buy them from your PROTO dealer *today!* Send 10¢ for catalog of entire line to

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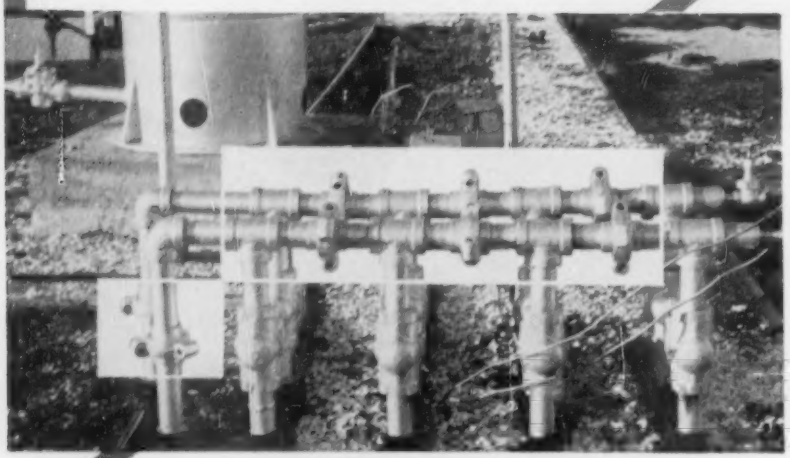
PERFECT CONNECTIONS



for a PRODUCTION HEADER

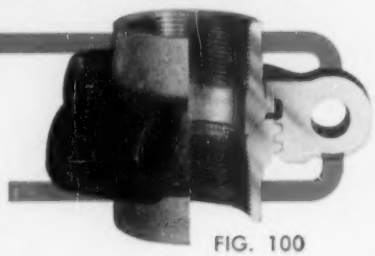


FIG. 100

WECO UNIONS

• Perfect because these WECO Fig. 100 Unions make-up easily and quickly—because their ball and cone seat seals, and stays sealed —because the "Bar-Nut" permits tightening with an ordinary bar or hammer.

Make-up your production headers with WECO Unions. Regardless of pipe size or line pressure, you can get exactly the WECO Union you need to do the job better.

Sizes: 2", 2½", 3", 4", 6", 8".

PESA

it's wise to standardize with... WECO

WECO ®

WELL EQUIPMENT MFG. CORP. • Division of Chiksan Company • HOUSTON 1, TEXAS

fuel, such as coal or oil, and so they cannot 'shop around' for better prices.

"Well, how about it? The fact is, of course, that most of these new users of gas formerly used coal or oil. They were free to switch to gas if they chose, and they chose to do so by the millions. Why? Because gas, besides its advantages of cleanliness and convenience, was cheaper in terms of heating units per dollar of cost . . .

"The consumers are 'captives' at the end of the gas line because of the price behavior of other fuels. They do not switch to other fuels because it would hurt their pocketbooks, although you can be sure they would do so if there was anything to be gained by it. 'Shopping around' would encounter only higher fuel costs. . . .

"As Senator Douglas concedes, the demand for natural gas grows daily. Gas consumption, he says accurately, is building up faster than gas reserves are being found. His remedy is peculiar—the imposition of price regulation that would cut down the incentive of producers to find and market new supplies of gas.

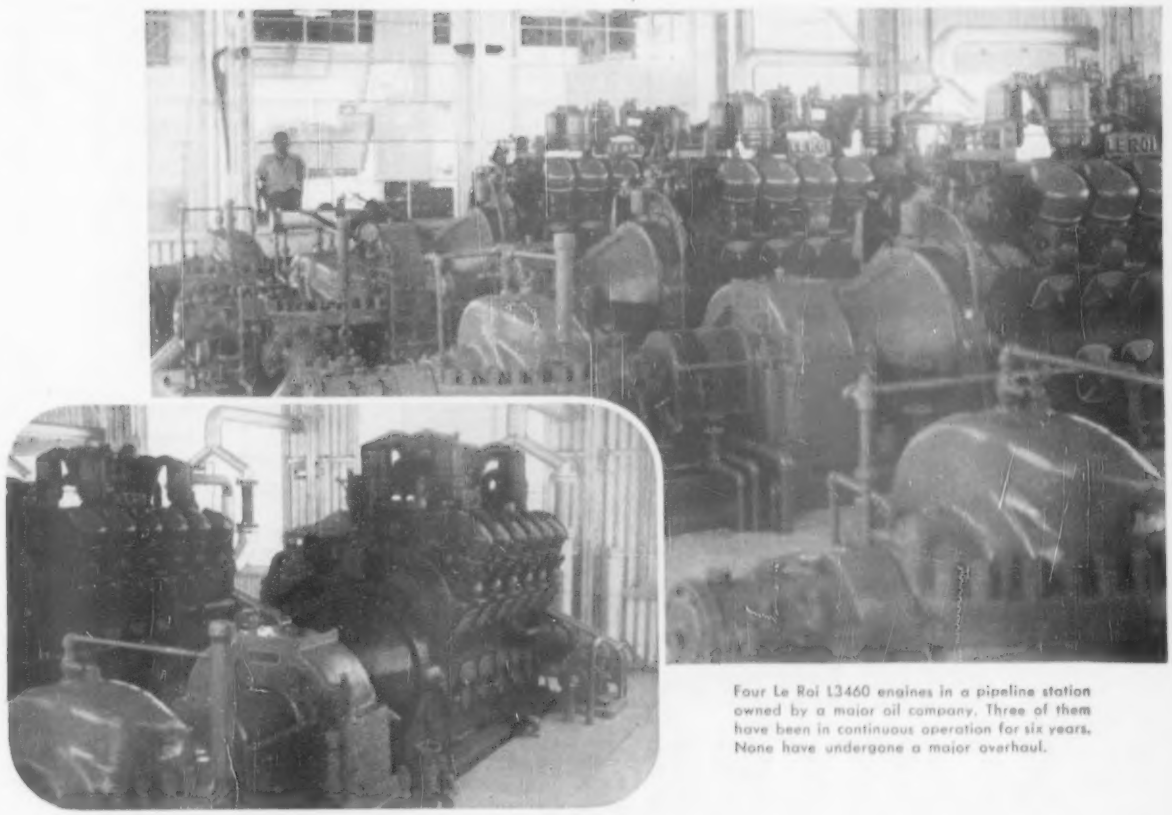
"Senator Douglas has a reputation as an economist. But it is strange economic reasoning indeed which says that, with more people wanting gas, the way to serve their interests is to take steps that would reduce the supply. Most consumers, we think, would tell the senator they would prefer to be 'captives' at the end of a line adequately filled with gas than at the end of an empty one."

Editorial in Fort Worth Star-Telegram.

The A.P.I. and Highways

"Perhaps to a greater degree than any other industry, the petroleum industry finds its own welfare inextricably interwoven with the progress of highway development. In fact, it is not too much to say that our industry and the highway transportation system of this country have grown side by side during the past half century. Each has complemented and contributed to the growth of the other. By the same token, we fully recognize that the future progress of the petroleum industry will depend, in large measure, on the continuance of financial policies which will promote the sound development of the nation's road systems.

"The industry has long believed that the major responsibility for highway improvement should properly continue to be vested in the respective state governments. It is our conviction that this offers the surest, most equitable, and most efficient means of achieving the desired goal of adequate and continuing development of all types of highways at reasonable cost . . .



Four Le Roi L3460 engines in a pipeline station owned by a major oil company. Three of them have been in continuous operation for six years. None have undergone a major overhaul.

Power-Packed Pipeline Station

. . . uses Le Roi L3460's to provide plenty of low-cost pumping power

Le Roi's L3460 with 600 max. hp. and its bigger brother, the L4000 with 655 max. hp., are ideal for pipeline service on many counts. Here's why:

Plenty of power with good fuel economy — These engines develop 600 and 655 max. hp. with rock-bottom fuel consumption, and can be run on natural gas, gasoline, or butane. Advanced design manifolding, low friction bearings, and low power loss to accessories, all contribute to unusual operating economy.

Long engine life—Perhaps the best proof of this statement is found in the trouble-free performance experienced by users in installations like the one shown above. Basically the L3460 and L4000 are compact, high-output engines designed with short stroke to give you greater horsepower and speed, without compromising engine life. And that's exactly what they do for you.

More comfortable operating conditions—Water-cooled exhaust manifold cuts down engine heat in operating areas, yet provides fast engine warm-up. The smooth, clean lines of these engines prevent dirt from collecting —that's why they are so easy to keep clean.

Compact V-12 design packs a lot of horsepower in a small space—to give you more horsepower per dollar. This, plus vibrationless performance, reduces foundation costs, simplifies installation.

We think that if you see an L3460 or L4000 in operation you'll agree that they provide the answer to low-cost pumping power. Have your supply house or Le Roi distributor show you one at work. Bulletins are available upon request—just write us.

P-140

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Milwaukee 14, Wisconsin

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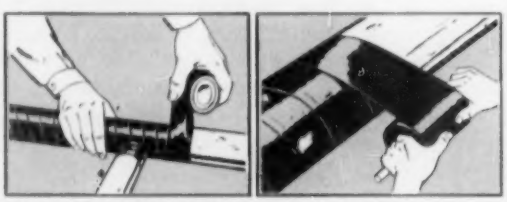

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"In the light of this conviction, we are deeply concerned over the pending legislation which would, in our opinion, mean an abandonment of this time-tested federal - state - local relationship and which would seriously undermine and impair the ability of the states to carry out their functions in this field.

"I am referring particularly to those provisions which would increase the federal manufacturers' excise taxes on gasoline, special fuels, and diesel fuel, as well as other federal automotive excise increases which your committee is considering. Under the terms of this measure, the proceeds of these taxes would be linked—for all practical purposes—to the federal-aid highway program at least until the year 1970. In view of the history of these taxes—which have been extended and increased in spite of their temporary character—there appears to be little reason to hope that they will be permitted to revert to lower rates even after 1970."

Robert H. Scholl, vice president and director of Esso Standard Oil Co., in a statement submitted on behalf of the American Petroleum Institute at a hearing of the House public works committee on proposed federal highway legislation.

Journal Chart Prompts Article

Dear Sir:

We have certainly enjoyed the Journal's latest wall chart, "Oil and Gas Field Classifier" (insert to April 4, 1955, issue). Each member of Ohio Oil Co.'s "The Beacon" has one and we have one on the bulletin board which draws many questions.

An idea was born of the Journal's classifier, in fact, and we need the Journal's approval and possible help.

Tommy Patterson here suggested that we do an article entitled "So You Want to Drill an Oil Well?" or some such title. We would then use some of the charts from the Journal's classifier in line plates plus some art by our own artist. Probable lead photo would be of an oil man scratching his head, with a rig in the background. We would sprinkle in actual photos of setting up a rig with dollar estimates showing in each picture.

How does the idea sound to the Journal and would we be permitted to copy the "Classifier" or use the original art from it? Credit line to the Journal, naturally.

Eugene L. Price
Personnel Department
Ohio Oil Co.
Findlay, Ohio.

Editor's Note: Sounds like an excellent idea. We'd be happy to have Ohio Oil incorporate the material.

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access to your bolted tanks with steel walkways and stairways

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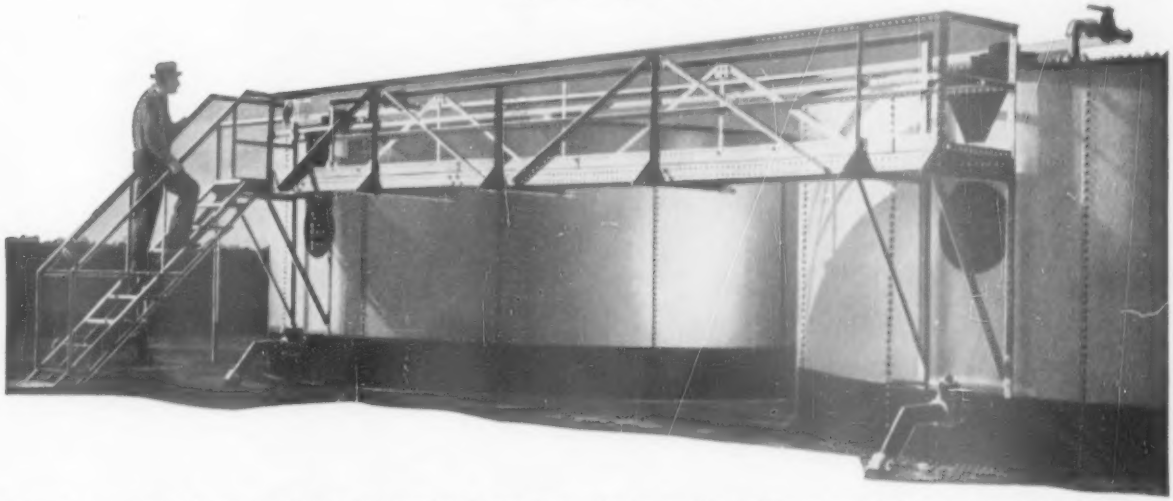

Complete your tank battery with easy-to-assemble Butler steel walkways and stairways and you'll be sure your personnel will work in safety, with greatest efficiency.

These firmly cross-braced walkways and stairways give years of service, require little maintenance, fit any A.P.I. bolted tank. Stair treads are wide, roomy, and burr-punched for safety. Hand rails have rounded corners, are convenient, easy to reach.

These quality walkways and stairways will protect your employees and save their time wherever walkways and stairways are used, such as for trackside loading racks.

The next time you bring in a well, call your nearby Butler distributor. He has the right size and type of walkways, stairways, and Butler bolted tanks on hand to fit your needs exactly, and the organization to erect them quickly.

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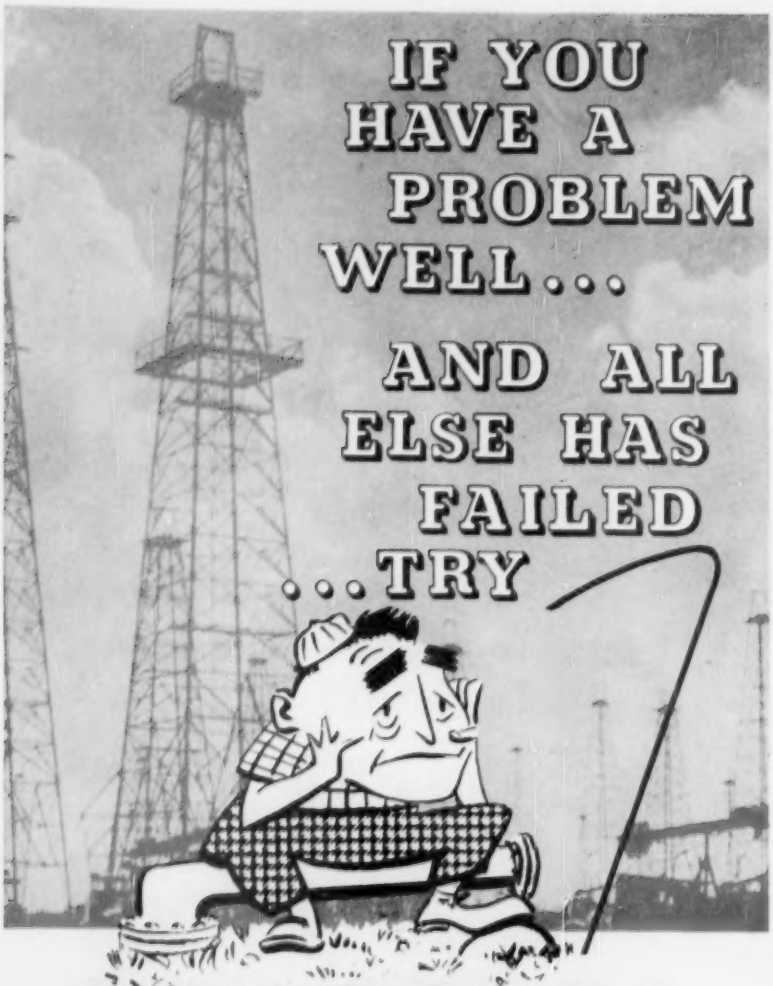

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CALENDAR

AUGUST

15-16 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

15-17 Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Ore.

19 Southern Gas Association, transmission section round table on pipeline engineering, natural-gas gathering and processing, and pipeline operations and maintenance, Hotel Adolphus, Dallas.

29-31 15th annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

26-Sept. 15 Graduate summer session in reservoir engineering, University of Texas, Austin.

SEPTEMBER

2-3 Association of Desk and Derrick Clubs of North America, fourth annual convention, Commodore Hotel, New York City.

11-13 Independent Natural Gas Association of America, annual meeting, Jasper Park Lodge, Jasper Park, Jasper, Alberta, Canada.

12-14 American Institute of Electrical Engineers, electrical conference of the petroleum industry, Shamrock Hotel, Houston.

12-16 Tenth National Instrument Conference and Exhibit, Los Angeles, Calif.

12-16 Second International Instrument Congress and Exposition and tenth National Instrument Conference and Exhibit, Shrine Auditorium, Los Angeles.

14 American Association of Petroleum Geologists Western Canada regional meeting, and Alberta Society of Petroleum Geologists 5th annual field conference, Jasper Park Lodge, Jasper National Park, Alberta.

14-16 National Petroleum Association, 53rd annual meeting, Traymore Hotel, Atlantic City, N. J.

14-17 American Association of Petroleum Geologists, western Canada regional meeting and fifth annual field conference of Alberta Society of Petroleum Geologists, Jasper, Alberta, Canada.

22-23 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

22-23 Louisiana - Arkansas Division, Mid-Continent Oil and Gas Association, annual membership meeting, Roosevelt Hotel, New Orleans.

25-28 American Society of Mechanical Engineers, Petroleum Mechanical Engineering Conference, Roosevelt Hotel, New Orleans.

26-28 American Association of Oilwell Drilling Contractors, fifteenth annual meeting, Rice Hotel, Houston.

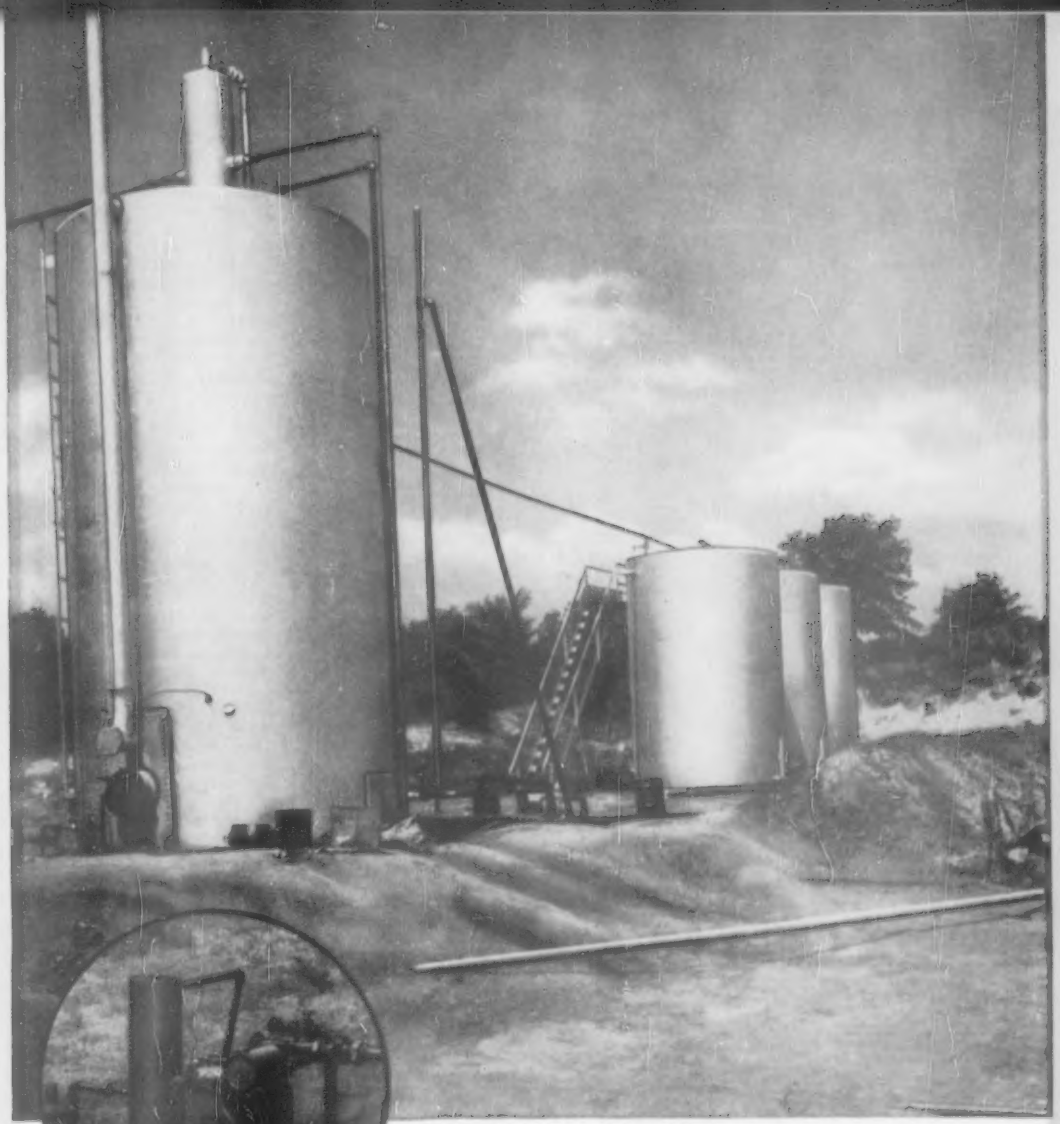
26-28 American Institute of Chemical Engineers, fall national meeting, Lake Placid Club, Lake Placid, N. Y.

29 Natural Gasoline Association of America, Oklahoma regional meeting, Skirvin Hotel, Oklahoma City.

OCTOBER

2-5 American Institute of Mining and Metallurgical Engineers, Petroleum Branch, fall meeting, Roosevelt Hotel, New Orleans.

2-6 American Society for Testing Materials, Committee D-2, petroleum prod-



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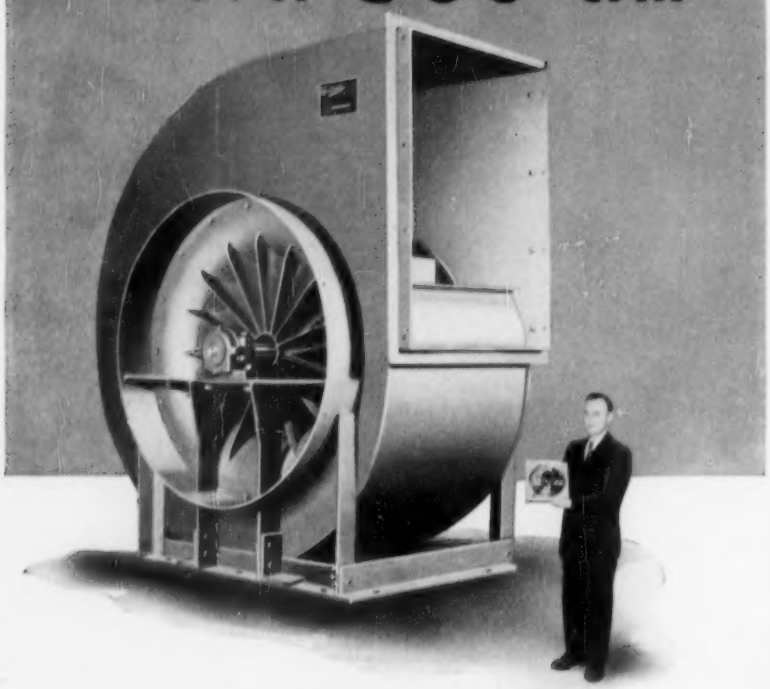

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ucts and lubricants, Statler Hotel, Washington, D. C.

3-4 Texas Mid-Continent Oil and Gas Association, 36th annual meeting, Baker Hotel, Dallas.

3-6 Society of Exploration Geophysicists, 25th annual meeting, Shirley Savoy Hotel, Denver.

3-6 Rocky Mountain Association of Petroleum Geologists and Denver Geophysical Society, 25th annual meeting, Denver.

9-15 American Petroleum Institute, Oil Progress Week.

12-14 National Association of Corrosion Engineers, sixth biennial Permian basin tour, Lincoln Hotel, Odessa, Tex.

12-14 Gulf Coast Association of Geological Societies, annual meeting, Buena Vista Hotel, Biloxi, Miss.

12-14 Gas Appliance Manufacturers Association, El Mirador, Palm Springs, Calif.

13-14 California Natural Gasoline Association, annual fall meeting, Ambassador Hotel, Los Angeles.

14 American Institute of Chemical Engineers, South Texas Section, 10th annual technical meeting, Galvez Hotel, Galveston, Tex.

14-15 National Society of Professional Engineers fall meeting, Peabody Hotel, Memphis, Tenn.

17-19 American Gas Association and Pacific Coast Gas Association, annual meeting, Ambassador, Biltmore, and Statler Hotels, Los Angeles.

18-22 National Safety Council, 43rd National Safety Congress and Exposition, Chicago.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Garrett Hotel, El Dorado, Ark.

24-27 National Association of Railroad and Utilities Commissioners, natural gas panel discussion, Asheville, N. C.

27-29 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

28 Natural Gasoline Association of America, southern regional meeting, Captain Shreve Hotel, Shreveport.

31-Nov. 1 Independent Petroleum Association of America, annual meeting, Jefferson Hotel, St. Louis.

31-Nov. 2 National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER

2-4 American Association of Petroleum Geologists, Mid-Continent regional meeting, Skirvin Tower, Oklahoma City.

2-4 Society of Automotive Engineers, diesel engine meeting, Chase Hotel, St. Louis.

9-10 Society of Automotive Engineers, fuels and lubricants meeting, Bellevue-Stratford Hotel, Philadelphia.

10-11 American Association of Petroleum Geologists, Pacific Section annual convention, Biltmore Hotel, Los Angeles.

11-13 New Mexico Geological Society, in conjunction with Roswell Geological Society, sixth annual field conference, Truth or Consequences, N. M.

13-18 American Society of Mechanical Engineers, 75th anniversary meeting, Hilton and Blackstone Hotels, Chicago.

14-17 American Petroleum Institute, 35th annual meeting, Mark Hopkins, Fairmont, St. Francis and Palace Hotels, San Francisco.

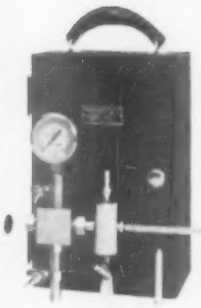
27-30 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit.

DEW POINT TESTER AND RECORDER

BUREAU OF MINES TYPE

for testing gases under pressure.

Records dew point of gases under pressure.



- **PRECISION DETERMINATIONS:** Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2°F.
- **ACCURACY:** Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
- **SAFETY:** Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.
- **SUITABILITY:** For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
- **CONTINUOUS RECORD:** of dew point gas
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- **RELIABLE RESULTS:** Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines.

This instrument records dew point of a continuous sample of natural gas at line pressure up to 1,500 psi.

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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING...

The Poop on the Scoop

YOU can learn some interesting things about the oil industry by reading the daily papers, things you never find in oil publications or the public statements of oil companies.

For instance, we recently ran across a piece on Middle East oil by a high-level foreign political analyst for an American news syndicate. This pundit took a quick swing through some of the Persian Gulf area and dug up a sensational scoop.

If we can keep the Commies out of the Middle East, he said, the world will have all the oil it can use for the next 75 years, but if we let the Iron Curtain ring down on this part of the globe we will all be out of oil in 25 years or less.

He based this on what he said were sensational but very hush-hush discoveries of oil in the Middle East during the past year—discoveries so enormous that the discoverers are afraid to reveal them. Instead of the accepted figure of 50 billion barrels of reserves, he said, the Middle East really can produce 200 billion barrels. He added that the United States has only 35 billion barrels of oil and the rest of the world even less.

Now, he said, the new Middle East discoveries bring the world's oil total to 260 billion barrels, and this will keep everybody well supplied for at least the next 75 years.

The only hitch in all this is that our favorite consulting economist figures things a little differently. He claims no inside knowledge of recent Middle East discoveries, but with the aid of his desk calculator he quickly figured out that the world will need a total of 570 billion barrels of oil during the next 75 years even if demand increases only 1 per cent a year—and demand is increasing a whole lot faster than that.

So our conclusion, foreign political analysts to the contrary notwithstanding, is that, despite the outcome of Communist aggression and Middle East exploration, this old world is going to need a lot more oil than is presently in sight anywhere, and oil men had better keep on punching holes in the ground in the United States and every other likely place.

Along the Right-of-Way

OUR Pittsburgh contributor, A. T. Bennett, seems to have appointed himself unofficial amanuensis to the pipeline right-of-way profession, for he kicks in with a couple more anecdotes to go with those we printed here a few weeks back.

While working r/w on the Algonquin line in Connecticut several years ago (he writes) we were having all kinds of delays and setbacks due to injunctions, condemnations, and town meetings. Work was being stopped and started abruptly.

Naturally, when we could work we really kicked off, and hired a lot of local men to help out. At one time we had three gangs of r/w cutters working about 5 miles apart. This made it pretty hard for the timekeeper to keep track of all the men. The contractor's r/w foreman and about 20 of his regular crew were all from Arkansas. The foreman got exasperated with the timekeeper's inability to give him the time on a certain man.

"How can I tell this particular guy from all the rest of you Arkansawyers?" asked the Yankee timekeeper.

"Easy," snapped the foreman. "He's the only one got teeth."

Another time (Bennett continues) while buying r/w near Marietta, Pa., I wanted to cross the farm of a Mennonite farmer, but couldn't find him home. So I bought crossings on the farms on both sides, and finally this farmer and his family showed up. He looked more dead than alive, and I learned he had just got out of a long spell in the hospital following a serious operation. I offered him the same price I had paid his neighbors to cross his farm, and when I named the figure he turned to his family and said:

"The way of the Lord is wonderful. That price is just exactly the amount of my doctor and hospital bill. I didn't know where I was going to get the money to pay it. The way of the Lord is wonderful."

—*Henry D. Ralph.*

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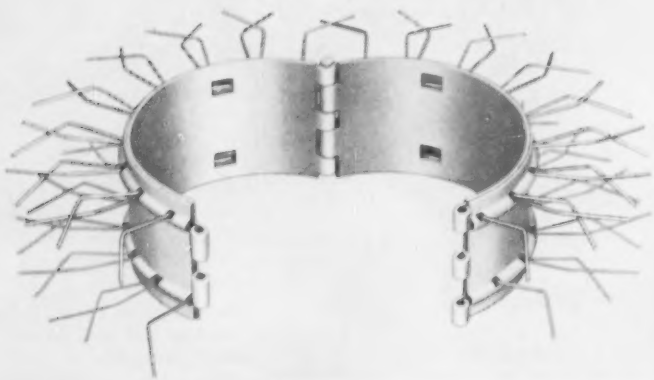
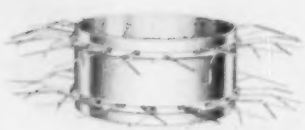
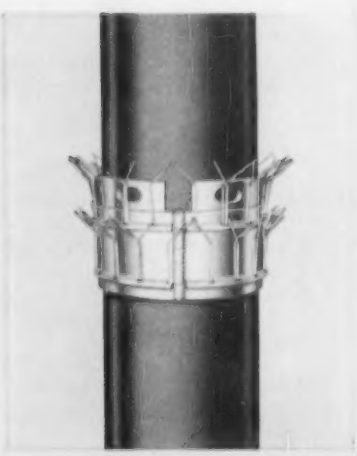
The new Baker Model "C" Wall Scratcher provides you with CONTROLLED SCRATCHING . . . allows you to remove mud cake effectively, *but only from the area to be cemented.* More efficient removal of mud cake in the cementing area is assured by two rows of Scratcher Wires that provide more effective coverage of the 360° surface of the well bore than any other available scratcher. When the casing is being run, however, these wires lay nearly flat against the casing and thus leave the expensive and vital filter cake built up on areas other than the cementing area virtually undisturbed.

- *Effective and efficient removal of mud cake . . . but only from the area to be cemented.*
- *Virtually undisturbed filter cake in areas outside of the cementing area.*
- *Minimized possibility of mud "balling up" on Scratcher and resultant restriction of annulus.*







Examine this completely new Scratcher at your nearest supply store. Ask for the Baker MODEL "C" Wall Scratcher, or, if more convenient contact your nearest Baker Representative.

Comparison will reveal that NO OTHER AVAILABLE SCRATCHER CAN CONTRIBUTE MORE TO THE SUCCESS OF A PRIMARY CEMENT JOB.

The completely new design of the Model "C" Wall Scratcher provides more than ample strength to withstand rugged down-hole travel as well as the strain placed on the scratcher during the removal of mud cake. Greater strength is achieved through the additional thickness created by DOUBLE-SHELL CONSTRUCTION . . . DOUBLE RIDGES formed into the outer shell provide increased rigidity . . . EXTRA HEAVY HINGE (in hinged model) formed as an integral part of inner shell provides extra strength at this vital point . . . a new closing pin in this model permits easier installation and provides a positive lock.

Choice of Hinged or Solid Ring

The Baker Model "C" Wall Scratcher is available with a hinge for easier mounting as the Baker Model "C" Hinge-Lok Wall Scratcher, Product No. 900-C. A model without the hinge, the Baker Model "C" Solid-Ring Wall Scratcher, Product No. 901-C is also available.

Choice of Scratcher Wire Length

The Baker Model "C" Wall Scratcher in both the hinged and solid-ring versions is available for use on all popular casing sizes in either of two scratcher wire lengths; . . . the C-25 (2½" wires) or the C-45 (4½" wires).

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BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

BAKER WALL SCRATCHER

This wildcat trend needs more of a boost

ARE we drilling too many wells? During the first half of this year 27,696 wells were drilled, and the forecast for all of this year is 56,430. This will be 2,500 wells—4.6 per cent—more than last year and twice as many as were drilled in the United States just 10 years ago.

Last winter, in the heat of the imports debate, some importers ventured the opinion that the cause of the domestic industry's trouble was not imports but too much drilling. That opinion got scant endorsement and has few arguments to support it. But to the extent that there is a grain of truth there, the fault is not so much in the total drilling as in its division between exploratory and development wells.

Drilling must continue to increase at more or less its recent rate of growth if we are going to maintain our reserves and productivity. But we probably could do with fewer field wells at the moment and we very definitely need more wildcatting.

WILDCATTING HAS BEEN ON THE DECLINE since the postwar peak year of 1951 when 23.1 per cent of all wells drilled were wildcats. The percentage was 23.0 in 1952, 22.4 in 1953, and 20.9 in 1954.

Fortunately, the trend seems to have turned. During the first half of this year, wildcats were 21.09 per cent of total completions. The schedule for the last half calls for 22.35 per cent.

This turn is fortunate because last year our proved reserves of crude gained very little while our unused producing capacity climbed above 2,000,000 bbl. per day. The obvious corrective would be to slow down on development drilling and speed up on wildcatting.

The outlook is for no slowing down in total development drilling—whatever effect that may have on shut-in producing capacity—but for an increase in wildcatting both absolutely and relatively.

From a long-range standpoint, the wildcat ratio should increase steadily, perhaps to at least 25 per cent of all wells. One reason for this is that discoveries these days seem to be smaller than they used to be, and so it takes more wildcats to find the places where a given number of development wells can be drilled.

MORE INCENTIVES FOR WILDCATTING seem to be needed. With the odds on a whopping discovery getting longer, the day of the old-time rank wildcatter may be passing. The independents, who still do the bulk of the wildcatting, seem to be getting more conservative. Perhaps the majors should do more wildcatting instead of buying reserves.

Economic factors which would help all around include an assured market for domestic crude, a higher crude price, and a downturn in excess producing capacity. This would not guarantee discovery of a given volume of reserves, but it would do much to stimulate the wildcatting without which our reserves most certainly will decline.

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SALES OFFICES: Des Moines, Shreveport, Toledo, Houston, Long Beach, Okla. City, Midland, Texas, San Francisco, Fresno, Seattle, Salt Lake City, E. Patterson, N. J., Hattiesburg Miss., Macon, Ga., St. Paul, Minn.

THIS WEEK . . . . . IN THE NEWS

Offshore

• Two new pay zones have been tapped by Mecom Petroleums in Block 45 in the West Cameron area off Louisiana. The well, A-4 State Lease 1133, flowed 266 bbl. of 36.6°-gravity oil through a 10/64-in. choke from 8,640-50 ft. It tested 3,882 M.c.f. of gas and 61.8 bbl. of distillate daily through a ¼-in. choke from 8,600-06 ft. Mecom leased Block 45 and half of adjoining Block 56 from Stanolind, which opened production in the area in 1949. Stanolind has an override on the Mecom lease.

Government

• The boom in demand for oil products expected from a multibillion-dollar federal highway program is out for this year. But the industry won't be saddled with higher automotive taxes either. The House has defeated both Democratic and Republican-sponsored road bills.

International

• Guatemala may run into trouble interesting big risk capital in oil exploration under terms of its new oil law. Oil men generally expressed disappointment with terms of the new law. They feel conditions should be more attractive moneywise. Regulations to implement the law or later amendments may change the picture and make major firms willing to risk the high costs and to overlook the uncertain geology.

• The rapid rise of free world oil production has been checked. The string of six consecutive monthly records was snapped when May output declined 289,800 bbl. daily to 13,403,000 bbl. The United States led the downturn.

Storage

• Underground storage of L.P.G. is up 73 per cent since last year and still increasing. An Oil and Gas Journal survey puts present storage capacity at 15,900,000 bbl. in 173 projects. An additional 20 projects are planned or being built to boost capacity to at least 22,388,000 bbl.

Exploration

• A flurry of deep drilling will probably follow Union Oil's wildcat strike in the Disturbed Belt in Montana. The test, 1 Otter Woman Morning Gun, extends Mississippian wet-gas production from Canada's Foothills Belt across the border into the U. S. The well may be the year's most significant discovery in the Rockies and Montana's most important strike since the discovery of Poplar field in 1951.

• Idaho has joined the list of producing states. Oroco Oil & Gas has completed its I Johnson for 400 M.c.f. of gas daily. Idaho is the nation's thirty-first producing state.

• Activity may pick up in the western portion of the Williston basin as result of Rothschild Oil's indicated Ordovician discovery in Fallon County, Montana. The test is east of the Cedar Creek anticline and may usher in more deep drilling between the anticline and the Fryburg area of North Dakota.

Pipeline

• West Coast Pipe Line Co.'s hopes for an emergency crude line from Texas to California are still alive—but just barely. The Joint Chiefs of Staff will take another look at the need for such a line and report to Congress. But there's no indication the military will alter its opposition to a federal subsidy for the line.

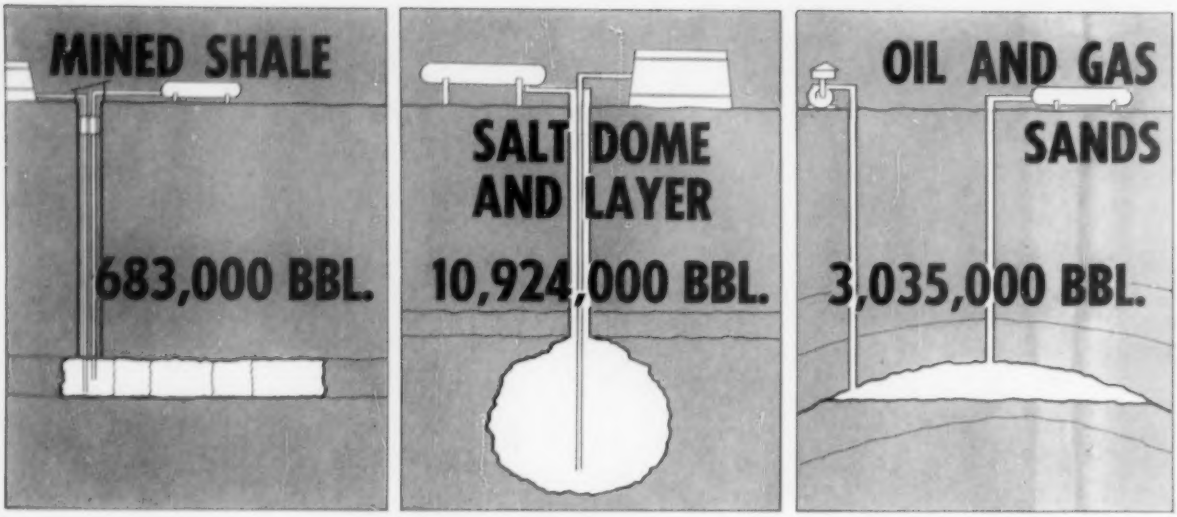
• Senator Kefauver raises the question of federal control over crude-oil lines. There's no push in Government for a move in this direction. But the fact that such an extension of federal authority has been suggested points to an industry problem that is far from solved.

Refining

• Octanes again climb higher, and there's no letup in prospect. Du Pont study shows a 48-city unweighted average of 94.9 on July 1 for premium, 87.4 for regular. Both premium and regular are up 2.1 numbers over a year ago. Ethyl Corp. survey sets the figures even higher. Its weighted averages for the entire nation now are 95.8 for premium and 88.5 for regular.

• A new round of refinery construction which will boost ratings even higher gets under way. U.O.P. discloses Aurora Gasoline is now building the world's first Rexformer. The world's first Iso-Plus unit has been licensed for construction in Italy, and a second Rexformer is now planned by Cities Service for its Ponca City refinery.

• Phillips grants the first license on its new polyethylene process to W. R. Grace & Co. Grace plans to build an $18,000,000 plant next year. Site is not yet selected. Initial operation is scheduled for 1957.



Cavern capacity now 15,900,000 bbl. . . .

. . . L.P.G. Storage Hits New Peak

Joe Reilly

THE nation's liquefied petroleum gas industry is going underground in a big way.

Its underground storage, virtually nothing 5 years ago, now stands at a whopping 15,900,000 bbl.—up 73 per cent the past year.

In that short span producers and distributors of L.P.G. have converted depleted gas reservoirs, salt domes and layers, sandstone formations and shale deposits into vast warehousing caverns.

But despite this activity, the trend is for more storage underground. If all the nation's caverns used for L.P.G. storage were full, the supply would equal slightly more than a month's peak wintertime demand.

A survey by The Oil and Gas Journal shows that major producers and distributors in the United States have added underground facilities for more than 6,900,000 bbl. of L.P.G. during the year.

A similar survey made about the same time last year placed the total at just slightly more than 9,000,000 bbl. *(The Oil and Gas Journal, June 7, 1954, page 66).*

In addition to the 173 storage projects now in operation, the survey indicates that nearly 30 more are in the planning or construction stage. Ultimate capacity of all such storage facilities in the United States is expected to total at least 22,388,000 bbl.

The projected storage capacity would provide waiting room for about 16 per cent of the 130,000,000 bbl. of L.P.G. expected to be sold in the United States this year. On the basis of last December's sales of 14,029,000 bbl., projects already in use could hold enough L.P.G. to meet the nation's entire demand for 35 days.

Curtails waste . . . Rapid expansion of underground storage capacity has done much in the past 5 years to curtail waste of excess summer production.

It's still true that L.P.G. prices often vary inversely with the temperature. But huge underground supplies which previously would have been dumped on a weak market in the warm months can now be held for top winter prices.

Stabilizing the market is only one of the goals of producers who pour millions of dollars into giant L.P.G. caverns. In fact, some now fear that big inventories, by reducing the normal winter scarcity of L.P.G., may serve more often as a price ceiling than as a price floor.

The effect of underground storage on prices has not been fully determined, but nearly all L.P.G. men would agree that the industry couldn't have grown to its present stature without some kind of off-season storage. Underground reserves have permitted more reliable service to consumers. Butane and propane users would have relied on other fuels if they were not assured of a year-round supply. And underground projects are the cheapest guarantee against empty consumer tanks.

R. L. Loofbourow, Minneapolis consulting engineer who has devoted much study to the problems of underground storage, says cavities dissolved in salt formations can be prepared for L.P.G. storage for as little as 50 cents to $2 per bbl. capacity. Other types of caverns for butane or propane may be excavated for $2.50 to $10 per bbl., depending on formation and size.

Even the latter projects provide much cheaper storage than do steel pressure vessels. These will cost up to $20 or $25 per bbl. capacity.

Most in Southwest . . . Since washing of salt domes and salt layers is the easiest and cheapest way to "excavate" storage caverns, most of the big underground projects are in the Southwest and Gulf Coast areas where these formations are most common. A cavern

Big Storage Unit Approved

AUSTIN—The Texas Railroad Commission has approved Phillips Petroleum Co.'s plan to create a huge underground-storage area for L.P.G. in the Clemens salt dome of Brazoria County. Storage products would come from Phillips' Sweeny refinery 14 miles from the dome.

Initially, only one of four planned storage cavities will be leached out. Salt in it is topped at 1,150 ft. It will have a capacity of 200,000 bbl. of L.P.G.

Phillips already is drilling the first storage well.

of this type can be started merely by drilling a well into the salt structure and circulating fresh water through it. Water, which is used to displace the stored fuel, dissolves more salt with each operation and thereby enlarges the cavity from season to season.

Texas alone has more than 10,000,000 bbl. in underground storage capacity, most of it in salt domes or salt layers. Most of the other big producing states, such as Kansas, Louisiana, and New Mexico, also have big salt caverns devoted to L.P.G. storage.

The fact that most of the underground storage is in producing areas has left unsolved another problem—how to get L.P.G. to the big winter markets in the North and East.

Because of winter transportation

(Continued on page 63)

Nation's L.P.G. Caverns—Their Size and Location

Company and county—Type of storage—	Capacity in bbl.—Present	Capacity in bbl.—Ultimate	Product
CALIFORNIA			
Standard Oil Co. of California:			
Los Angeles—Water sand	100,000	100,000	Propane
Los Angeles—Water sand	100,000	100,000	Butane
ILLINOIS			
National Petro-Chemicals Corp.:			
Douglas—Mined shale	150,000	150,000	Propane
Phillips Petroleum Co.:			
Kankakee—Mined shale	260,000	260,000	Propane
Warren Petroleum Corp.:			
Kane—Mined shale	50,000	50,000	L.P.G.
White—Mined shale	50,000	50,000	L.P.G.
IOWA			
Cities Service Oil Co.:			
Des Moines—Mined		100,000	Propane
KANSAS			
Cities Service Oil Co.:			
Reno—Salt layer	44,000	50,000	Butane
Reno—Salt layer	50,000	50,000	Butane
Reno—Salt layer	32,000	50,000	Propane
Reno—Salt layer	50,000	50,000	Propane
Reno—Salt layer	50,000	50,000	Propane
Reno—Salt layer	50,000	50,000	Propane
Reno—Salt layer		50,000	Propane
Reno—Salt layer		50,000	Propane
National Cooperative Refinery Association:			
McPherson—Salt layer	45,000	50,000	Propane
McPherson—Salt layer	45,000	50,000	Propane
McPherson—Salt layer	45,000	45,000	Butane
McPherson—Salt layer		45,000	Butane
Phillips Petroleum Co.:			
Kingman—Salt layer	88,000	100,000	Propane
Kingman—Salt layer	73,000	100,000	Propane
Skelly Oil Co.:†			
McPherson—Salt layer	22,000	50,000	L.P.G.
McPherson—Salt layer	29,000	50,000	L.P.G.
McPherson—Salt layer	29,000	50,000	L.P.G.
McPherson—Salt layer	25,000	50,000	L.P.G.
McPherson—Salt layer	25,000	50,000	L.P.G.
McPherson—Salt layer	16,000	30,000	L.P.G.
Stanolind Oil & Gas Co.:			
Grant—Salt layer	27,000	27,000	Butane
Grant—Salt layer	25,000	25,000	Propane
Grant—Salt layer	26,000	26,000	Propane
Grant—Salt layer	25,000	25,000	Butane
Grant—Salt layer	25,000	25,000	Butane
Grant—Salt layer	25,000	25,000	Propane
LOUISIANA			
Esso Standard Oil Co.:			
Ascension—Salt dome		150,000	Butane
Ascension—Salt dome		150,000	Butane
Ascension—Salt dome		150,000	Propane
General Gas Corp.:†			
Bienville—Salt dome	100,000	200,000	B-P mix
Bienville—Salt dome	100,000	200,000	Propane
Bienville—Salt dome	84,000	100,000	Butane
Bienville—Salt dome	84,000	100,000	B-P mix
Gulf Oil Corp.:			
St. Landry—Salt dome		50,000	Propane
Petroleum Sales, Inc.:†			
Evangeline—Salt dome	100,000	100,000	B-P mix
Evangeline—Salt dome	50,000	100,000	B-P mix
Evangeline—Salt dome		100,000	Butane
Warren Petroleum Corp.:			
Bienville—Salt dome	130,000		L.P.G.
Bienville—Salt dome	70,000		L.P.G.
MICHIGAN			
Cities Service Oil Co.:			
Kent—Salt layer	100,000	100,000	Propane
Kent—Salt layer		100,000	Propane
Skelly Oil Co.:†			
Kent—Salt layer	50,000	100,000	Propane
Sun Oil Co.:			
Wayne—Salt layer	90,000		Propane
Wayne—Salt layer	135,000		Butane
MISSISSIPPI			
Anchor Petroleum Co.:			
Forrest—Salt dome	150,000	200,000	Propane
Forrest—Salt dome	150,000	200,000	B-P mix
Forrest—Salt dome	150,000	200,000	Propane
General Gas Corp.:			
Forrest—Salt dome	24,000	100,000	B-P mix
Forrest—Salt dome	36,000	100,000	Propane
Skelly Oil Co.:†			
Forrest—Salt dome	23,000	50,000	L.P.G.
Forrest—Salt dome	30,000	60,000	L.P.G.
Warren Petroleum Corp.:			
Forrest—Salt dome	125,000		L.P.G.
Forrest—Salt dome	190,000		L.P.G.
Forrest—Salt dome	200,000		L.P.G.
MISSOURI			
Missouri Hydro Gas Co.:†			
Greene—Mined limestone	25,000	25,000	B-P mix
NEW MEXICO			
Atlantic Refining Co.:			
Lea—Salt layer		50,000	Propane
Lea—Salt layer		50,000	Butane
El Paso Natural Gas Co.:			
Lea—Salt layer	50,000	50,000	L.P.G.
Lea—Salt layer	39,000	50,000	L.P.G.
Gulf Oil Corp.:			
Lea—Salt layer	50,000	50,000	Propane
Lea—Salt layer	30,000	50,000	Butane
Sacra Bros.:†			
Eddy—Salt layer	12,000	36,000	Propane
Eddy—Salt layer	36,000	36,000	Propane
Eddy—Salt layer		36,000	L.P.G.
Skelly Oil Co.:†			
Lea—Salt layer	70,000	70,000	Propane
Lea—Salt layer	51,000	70,000	Butane
Lea—Salt layer	16,000	30,000	L.P.G.
Warren Petroleum Corp.:			
Lea—Salt layer	80,000		L.P.G.
Lea—Salt layer	43,000		L.P.G.
NEW YORK			
Anchor Petroleum Co.:			
Steuben—Salt layer	100,000	175,000	Propane
Steuben—Salt layer	100,000	175,000	Propane
Steuben—Salt layer		175,000	Propane
Suburban Propane Gas Corp.:			
Cortland—Salt layer	100,000	125,000	Propane
OHIO			
Standard Oil Co. (Ohio):			
Allen—Mined rock		30,000	Propane
Allen—Mined rock		30,000	Propane
OKLAHOMA			
Carter Oil Co.:			
Pontotoc—Abd. oil wells			L.P.G.
Seminole—Abd. oil wells			L.P.G.
Seminole—Abd. oil wells			L.P.G.
Shell Oil Co.:			
Beckham—Salt layer	15,000	15,000	Propane

Company and county—Type of storage—	Capacity in bbl. Present	Capacity in bbl. Ultimate	Product
Sinclair Oil & Gas Co.:			
Seminole—Mined shale	110,000	110,000	Propane
TEXAS			
Anchor Petroleum Co.:			
Hardin—Salt dome		200,000	Butane
Hardin—Salt dome		200,000	L.P.G.
Martin—Salt layer	60,000	80,000	Propane
Martin—Salt layer	60,000	80,000	Propane
Martin—Salt layer	60,000	80,000	Propane
Martin—Salt layer	60,000	80,000	Butane
Martin—Salt layer	50,000	80,000	Butane
Martin—Salt layer	50,000	80,000	Butane
Cities Service Oil Co.:			
Gray—Salt layer	75,000	75,000	Propane
Gray—Salt layer	50,000	75,000	Propane
Continental Oil Co.:			
Reagan—Salt layer	38,000	50,000	Propane
Cosden Petroleum Corp.:			
Howard—Salt layer	50,000	50,000	Butane
Dorchester Corp.:			
Carson—Salt layer	25,000	25,000	Propane
Carson—Salt layer	25,000	25,000	Butane
Dow Chemical Co.:†			
Brazoria—Salt dome	100,000	100,000	Propane
Brazoria—Salt dome	200,000	200,000	Propane
Ellis Transport Corp.:			
Harris—Salt well	200,000	200,000	Butane
Harris—Salt well	200,000	200,000	Propane
El Paso Natural Gas Co.:			
Reagan—Salt layer	123,000	150,000	L.P.G.
Reagan—Salt layer	65,000	150,000	L.P.G.
Reagan—Salt layer	61,000	150,000	L.P.G.
Reagan—Salt layer	47,000	150,000	L.P.G.
Reagan—Salt layer	17,000	150,000	L.P.G.
Reagan—Salt layer	30,000	150,000	L.P.G.
Reagan—Salt layer	8,000	150,000	L.P.G.
Reagan—Salt layer	2,000	150,000	L.P.G.
Reagan—Salt layer		150,000	L.P.G.
Reagan—Salt layer		150,000	L.P.G.
Enterprise Petroleum Gas Co.:†			
Wood—Salt dome	50,000	50,000	B-P mix
Wood—Salt dome	50,000	50,000	Propane
Freestone Underground Storage Corp.:			
Freestone—Salt dome	75,000	75,000	Propane
Freestone—Salt dome	50,000	50,000	B-P mix
Gulf Oil Corp.:			
Crane—Salt layer	30,000	50,000	Propane
Jefferson—Salt dome	150,000	150,000	Ethylene
Jefferson—Salt dome	160,000	160,000	Propane
Jefferson—Salt dome	210,000	250,000	Butane
Humble Oil & Refining Co.:			
Waller—gas sand	500,000	Undeterm.	Butane
Waller—gas sand	1,000,000	Undeterm.	Propane-ethane mix
La Gloria Corp.:			
Jim Wells—Sand	72,000	72,000	Butane
Jim Wells—Sand	72,000	72,000	Propane
Lion Oil Co. (as operator):			
Scurry—Salt layer	128,000	150,000	Propane
Scurry—Salt layer	49,000	150,000	Propane
Scurry—Salt layer	87,000	150,000	Propane
Scurry—Salt layer	124,000	150,000	Butane
Llano Grande Corp.:			
Cochran—Salt layer		50,000	L.P.G.
Cochran—Salt layer		50,000	L.P.G.
Magnolia Petroleum Co.:			
Jim Wells—Sand	*150,000	150,000	Propane
Liberty—Salt dome	100,000	500,000	Butane & propane
Pecos Co.:			
Midland—Salt layer	50,000	50,000	L.P.G.
Midland—Salt layer	50,000	50,000	L.P.G.
Midland—Salt layer	50,000	50,000	L.P.G.
Midland—Salt layer	50,000	50,000	L.P.G.
Phillips Petroleum Co.:			
Hutchinson—Salt layer	150,000	150,000	Propane
Hutchinson—Salt layer	154,000	154,000	Propane
Hutchinson—Salt layer	105,000	105,000	Isobutane
Hutchinson—Salt layer	180,000	180,000	Propane
Hutchinson—Salt layer	100,000	150,000	Propane
Hutchinson—Salt layer	110,000	150,000	Propane
Hutchinson—Salt layer	112,000	150,000	Propane
Brazoria—Salt dome		200,000	L.P.G.
Pure Oil Co.:			
Andrews—Salt layer	100,000	100,000	Propane
Andrews—Salt layer	87,000	87,000	Propane
Reef Fields Gasoline Corp.:			
Howard—Salt layer	47,000	47,000	Propane
Howard—Salt layer	57,000	57,000	Propane
Howard—Salt layer	43,000	43,000	Propane
Howard—Salt layer	39,000	43,000	Propane
Howard—Salt layer	43,000	43,000	n-Butane
Howard—Salt layer	38,000	43,000	n-Butane
Sid Richardson Gasoline Co.:			
Winkler—Salt-water sand			Butane & propane
Winkler—Salt layer	132,000	Undeterm.	Propane
Winkler—Salt layer	75,000	Undeterm.	Butane
Winkler—Salt layer	53,000	Undeterm.	Propane
Shamrock Oil & Gas Corp.:			
Moore—Oil sand	1,200,000	Undeterm.	B-P mix
Shell Oil Co.:			
Yoakum—Salt layer	180,000	180,000	Propane
Yoakum—Salt layer	150,000	150,000	Propane
Skelly Oil Co.:†			
Carson—Salt layer	77,000	77,000	Propane
Carson—Salt layer	59,000	59,000	Butane
Carson—Salt layer	68,000	68,000	Propane
Carson—Salt layer	27,000	27,000	
Southern Minerals Corp.:			
Nueces—Oil sand	41,000	53,000	B-P mix
Standard Oil Co. of Texas:			
Scurry—Salt layer	21,000	21,000	Propane
Scurry—Salt layer	30,000	30,000	Propane
Scurry—Salt layer		25,000	Propane
Stanolind Oil & Gas Co.:			
Andrews—Salt layer	*50,000	50,000	Propane
Andrews—Salt layer	*50,000	50,000	Butane
Andrews—Salt layer	*50,000	50,000	Propane
Ector—Salt layer	*125,000	150,000	Propane
Hockley—Salt layer	*50,000	50,000	Propane
Hockley—Salt layer	*67,000	100,000	Propane
Sun Oil Co.:			
Jefferson—Salt dome		100,000	Butane
Sunray Mid-Continent Oil Co.:			
Scurry—Salt layer	33,000	35,000	Propane
Scurry—Salt layer	32,000	35,000	Propane
Scurry—Salt layer	28,000	30,000	Propane
Scurry—Salt layer	54,000	55,000	Butane
Scurry—Salt layer	32,000	35,000	Butane
The Texas Co.:			
Hardin—Salt layer	110,000	110,000	Butane
Hardin—Salt layer	110,000	110,000	Butane
Hardin—Salt layer	110,000	110,000	Butane
Hardin—Salt layer		200,000	Butane
Scurry—Salt layer	55,000	55,000	Propane
Texas Natural Gasoline Corp.:			
Upton—Salt layer	148,000	200,000	Propane
Upton—Salt layer	120,000	150,000	Propane
Upton—Salt layer	85,000	150,000	Propane
Upton—Salt layer	75,000	150,000	Propane
Upton—Salt layer	100,000	150,000	Butane
Upton—Salt layer	90,000	150,000	Butane
Glasscock—Salt layer	100,000	150,000	Butane
Upton—Salt layer	100,000	150,000	Butane
Chambers	180,000	200,000	Butane
Chambers	180,000	200,000	Propane
Chambers	200,000	200,000	Butane
Chambers		200,000	Butane
Warren Petroleum Corp.:			
Stephens—Mined shale	25,000		B-P mix
Stephens—Mined shale	38,000		B-P mix
Smith—Salt dome	175,000		L.P.G.
Smith—Salt dome	225,000		L.P.G.
Smith—Salt dome	50,000		L.P.G.
VIRGINIA			
Bottled Gas Corp. of Virginia:			
Nelson—Abnd. railway tunnel		95,000	Propane
WISCONSIN			
United Petroleum Gas Co.:			
Pierce—Mined sandstone			Propane
Total	‡15,917,000	§22,388,000	

*Includes interest of other companies. †1954 data. ‡Does not include projects where capacity is not reported. §Includes present capacity when ultimate capacity is not shown.

difficulties, there has been a trend by some companies to provide more storage space in the colder regions. A few salt cavities are now in use in Michigan and New York. In addition, chambers have been mined in Illinois and Missouri, and other excavations are being considered in Ohio, Iowa, and Wisconsin.

An experiment in Wisconsin by United Petroleum Gas Co. may make it economically feasible to mine L.P.G. cavities in other sections of the U. S. where geological formations are not generally considered suitable.

A new sealant used in an experimental cavern in Pierce County, Wisconsin, promises to make common sandstone impermeable to gases.

Frank Carpenter, United Petroleum president, estimates that storage caverns using the synthetic-rubber sealant may be developed for L.P.G. storage at a cost of $3 to $5 per bbl. Experiments conducted by the company to date have been on a noncommercial scale, but Carpenter says plans are being made for a larger excavation.

Tunnel to be used . . . An attempt to convert an abandoned railroad tunnel for propane storage is still planned by Bottled Gas Corp. of Virginia, although the company failed in its first attempt. Bulkheads erected in the tunnel, near Afton, Va., were found to be inadequate, according to E. O. N. Williams, company president.

What is limit? . . . Even with new developments which may make large storage projects practical in the big industrial areas, it is debatable how far the L.P.G. industry will want to go in expanding its storage in the North and East.

As an official of a big Mid-Continent producer pointed out, the Southwest is advantageous for storage because L.P.G. can be shipped from there to either the Northeast or the upper Midwest, whichever has the greater demand.

If a company stores large volumes of L.P.G. in the East, it is gambling on a cold winter to drain its supply. But, the spokesman pointed out, in event of a mild winter, "there's not a thing you can do except sit on it."

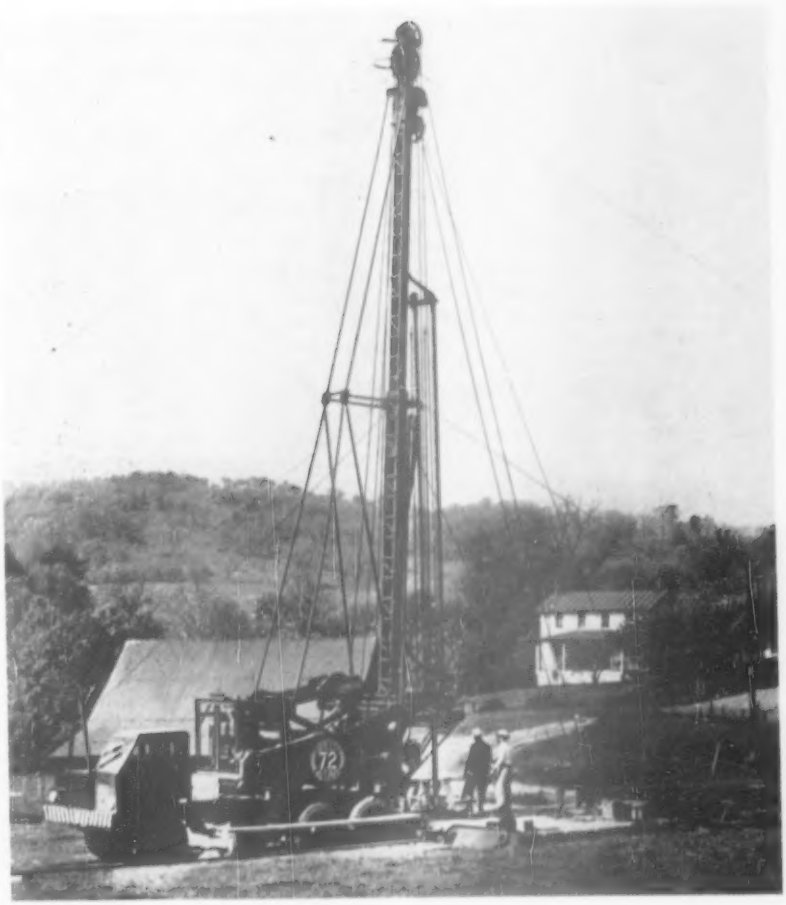
Rates for shipping the L.P.G. from eastern storage back south would be "prohibitive," he said. "And you've already paid the freight up there."

Shipping L.P.G. from the Southwest to New York costs about 6½ to 7½ cents per gal. Moving it against the normal freight pattern from New York to the Carolinas or Virginia would cost another 3 or 4 cents, and the product might sell for 9 cents or less after reaching its destination. On the other hand, the same fuel could be shipped directly from southwestern storage to the lower East Coast for 3 or 4 cents per gal.

Shortage still threat . . . Despite the fast expansion of underground storage capacity, many industry officials fear a severe cold spell still might bring a shortage of L.P.G. in some consuming areas. This threat will increase if underground supplies are low at the start of winter. Total stocks of L.P.G., including supplies at plants as well as those underground, were estimated at only 10,271,000 bbl. last October 31. With completion of projects now under construction or on paper, underground facilities alone could store more than twice that volume. Stocks at the end of May of this year were up 15.7 per cent from same date last year.

In the accompanying table, most of the projects listed without current capacity are in either the construction or planning stage. In a few instances, the projects are in operation but capacity figures are not available.

The ultimate capacity shown in the table is considered conservative. The total includes only present capacity of facilities for which the eventual size has not been determined.



Little Rotary Turns to Air to Cut Costs

UNIONTOWN, Pa.—Onego Corp. thinks it may have found a good way to cut drilling costs in Pennsylvania.

Onego, a small Pennsylvania and West Virginia producer, has hooked up compressed air to a large combination rotary and cable-tool water-well drilling rig. The result: 20 ft. an hour at a cost of less than $1 a foot. The company is using the unusual combination unit for air drilling 800 to 1,000-ft. wells on its leases in Greene County south of Pittsburgh. Cable-tool costs for shallow Pennsylvania wells run about $3 to $3.50 a foot.

H. Wesley Altman, Jr., Onego's operating vice president, hopes the company will be able to work out a well-a-week schedule with the new combination rig. The unit was built by Star-drill-Keystone Co., Beaver Falls, Pa.

Octane Pace Quickens

Aurora building first Rexformer, Cities Service plans one at Ponca City; Italian firm licenses Iso-Plus unit

NEW YORK.—There may be no letup in the octane race for a long time to come.

The groundwork for a new round of refinery construction—designed to produce gasoline of more than 100 octane—already has been laid.

Universal Oil Products Co. last week announced that the world's first Rexformer, a 5,500-bbl. unit, is now under construction at Aurora Gasoline Co.'s 35,000-bbl. refinery in Detroit.

The disclosure followed announcements that the world's first Iso-Plus unit will be built this year by S.A.R.O.M. in Ravenna, Italy, and that Cities Service Oil Co. is also planning a 6,000-bbl. Rexformer at its Ponca City, Okla., refinery.

The Aurora unit, the first licensed by U.O.P., will be realized through conversion of an existing Platformer.

The world's first catalytic reforming unit, a Platformer, was installed in a refinery now operating under Aurora's name. It was put into operation at the Muskegon, Mich., refinery of Old Dutch Refining Co. Aurora now operates the plant under a lease, but is expected to buy it.

S.A.R.O.M. has licensed the Iso-Plus process from Houdry Process Corp. and has contracted with Breda Electromaconia Locomotive to build the 2,000-bbl. unit at its 13,500-bbl. refinery.

Both processes can make gasoline with an octane number of 100 F-1 clear. Octane ratings in the United States now average between 95 and 96 for premium and about 88 for regular (see page 65).

What Rexforming does . . . Reformate from the Platformer is charged to a solvent-extraction unit where a low-octane fraction is separated from a high-octane fraction. In normal, single-pass catalytic reforming, this unconverted low-octane fraction of heavy paraffins depresses the quality of the total reformate. In Rexforming, it is returned to the Platformer where it is converted largely to aromatics. This permits record octane production at relatively mild processing conditions. Hence a good yield relationship. *(The Oil and Gas Journal, March 28, page 103).*

What Iso-Plus does . . . S.A.R.O.M. will use a combination of Houdriforming and thermal reforming of the Houdriformate. After pretreating and stripping, the virgin naphtha is Houdriformed to 87 F-1 clear octane. The debutanized reformate is thermally reformed to produce a high-octane product. The recovered propene and butenes from thermal reforming are converted to polymer gasoline. *(The Oil and Gas Journal, April 4, page 98).*

While the S.A.R.O.M. unit will be the first built as an Iso-Plus unit, it is not the first such operation. The initial operation was carried out in 1954 by Sun Oil Co. at its Toledo refinery. The company used existing catalytic and thermal reforming methods to conduct test runs on a commercial scale to evaluate the Iso-Plus method.

Previously tested . . . Sun is not presently operating the two types of units in this way because the product is not yet required to meet current octane levels. When the octane level has reached the point where this modified catalytic reforming operation becomes necessary, Sun can resume operations at Toledo and begin them at its Marcus Hook, Pa., refinery.

The Toledo refinery operates a 17,000-bbl. thermal reforming unit and a 14,000-bbl. Platformer. These units figured in the Iso-Plus tests.

New Firm in Good Spot as . . .

Oil Finances Uranium Hunt

DALLAS.—Oil and mining interests have joined forces in an unusual arrangement in which income from producing oil properties in Texas will finance an expanded search for uranium.

The new uranium company is General Minerals Corp. which last week filed a registration statement with the Securities and Exchange Commission in Washington. Its best-known and largest shareholder is General American Oil Co. of Texas, a large independent.

Other principal interest holders are S. Y. Guthrie of Dallas, Rosebud Oils, Inc., of Huron, S. D., and directors and officers of the three firms.

General Minerals will acquire, explore and develop uranium properties. Guthrie and Rosebud previously were in the uranium business on their own. Together they have turned over to the new firm interests or full ownership of 495 mining claims in Utah, Colorado, and South Dakota.

General American is contributing its working interest in 84 producing oil wells in Foster and Harper fields of Ector County and Wasson field of Gaines County, West Texas, as operating capital for General Minerals.

What is involved . . . The working oil interest ranges from 4 to 33 per cent of 11 leases totaling 1,800 acres. Production was 11,553 bbl. last year. Net developed reserve of the total interests was estimated by DeGolyer & MacNaughton at 1,769,368 bbl.

General Minerals now has 2,131,800 shares of common stock. It is seeking SEC approval of a new issue to the public of another 1,850,000 shares. If approved, the new issue would shrink present shareholders' interest nearly 50 per cent. The company plans to use $1 million of the new capital to retire two production payments on the West Texas oil properties.

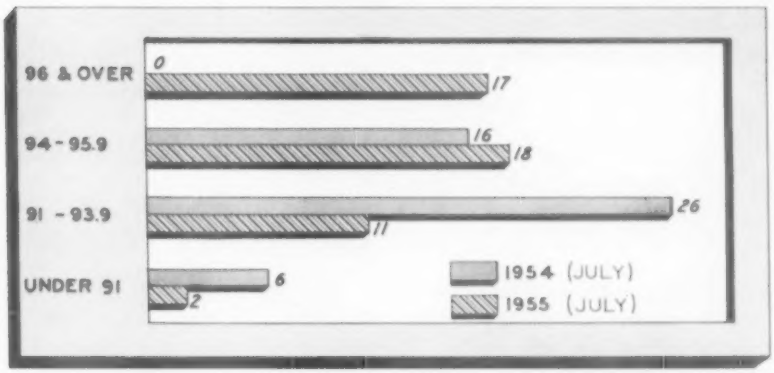
The uranium properties acquired from Guthrie and Rosebud are located in the Moab area of Grand County and the Green River area of Emery County in Utah; in Montrose, Miguel, and Mesa counties in Colorado; and in Custer, Fall River, and Harding counties in South Dakota. The company also may acquire by assignment from Tech Exploration Co. placer prospecting permits on 246,265 acres of New Mexico state lands.

General Minerals also through an exchange of stock acquired Research, Inc., of Dallas. This firm has needed equipment and engineering facilities for exploration and research in the mineral industries. It conducted an extensive research program for the Atomic Energy Commission in 1953 and 1954.

New officers . . . Officers of General Minerals are: A. H. Meadows, chairman of General American's executive committee, chairman of the board; M. E. Wilson and Gordon Simpson, General American's board chairman and president, respectively, directors; S. Y. Guthrie, president; T. A. Knight and Thomas R. Shugart, both of Dallas, vice presidents; and F. H. Connally, Dallas, secretary-treasurer.

Other directors are E. DeGolyer of DeGolyer & MacNaughton; H. Neil Mallon of Dresser Industries, Inc.; P. H. Feeney, president of Rosebud Oils; and Kenneth M. Willson, consulting geologist of Carmel, Calif.

Octanes Continue Their Upward Surge



Here's Du Pont's Rundown of 48 Cities

(Octane numbers are by research method, arithmetic averages by cities)

	PREMIUM				REGULAR			
	Octane number			TEL cont. cc./gal.	Octane number			TEL cont. cc./gal.
	July 1954	April 1955	July 1955	July 1955	July 1954	April 1955	July 1955	July 1955
Aberdeen, S. D.	91.5	91.3	92.7	2.54	84.6	84.8	86.1	2.00
Amarillo, Tex.	91.7	93.0	94.8	2.59	83.8	84.4	86.2	2.33
Atlanta, Ga.	94.5	95.8	96.9	2.31	86.3	87.5	89.2	2.62
Bakersfield, Calif.	91.3	93.2	95.1	2.89	83.7	83.8	85.5	2.56
Baltimore	94.5	96.6	96.8	2.45	89.2	90.0	91.0	2.16
Boston	94.4	96.1	96.3	2.20	89.3	90.4	90.9	2.47
Calgary	88.7	89.9	90.5	2.42	82.3	83.1	84.6	2.20
Casper, Wyo.	90.4	90.4	92.1	2.05	83.1	83.7	85.0	1.86
Charlotte, N. C.	94.5	96.0	96.4	2.32	86.9	88.5	88.9	2.52
Chicago	92.4	93.9	94.8	2.36	84.7	85.6	88.1	2.27
Cincinnati	93.4	94.7	95.1	2.37	87.8	89.0	89.9	1.82
Cleveland	93.2	94.7	94.9	2.42	88.4	89.2	90.0	1.78
Columbus	93.1	94.3	95.0	2.35	87.9	89.2	89.9	2.28
Corpus Christi, Tex.	94.1	96.5	96.6	2.85	85.4	86.7	87.7	2.41
Dallas—Fort Worth	94.6	96.4	96.9	2.84	85.9	86.5	87.0	2.75
Denver	89.9	90.4	91.7	2.01	82.7	84.1	84.8	1.69
Detroit	93.6	94.6	94.5	2.60	87.6	88.8	89.4	1.88
Edmonton	89.8	90.1	91.4	2.23	83.8	83.8	84.7	1.61
El Paso	92.4	92.7	94.3	2.39	82.6	82.3	83.4	2.01
Great Falls—Billings	91.6	93.2	93.9	2.18	84.2	86.3	86.1	2.16
Houston	94.8	96.9	97.0	2.90	86.2	87.1	87.4	2.61
Indianapolis	92.2	93.9	95.2	2.28	84.3	85.7	88.0	1.90
Jacksonville	94.4	96.0	96.6	2.37	88.0	89.6	90.2	2.39
Kansas City	91.9	92.8	93.8	2.38	84.4	84.5	86.2	2.14
Little Rock	94.5	96.3	96.8	2.82	85.6	87.5	88.7	2.79
Los Angeles	92.7	94.7	95.4	2.55	83.9	84.8	85.7	1.68
Louisville	93.9	95.4	96.5	2.73	86.6	87.7	88.9	2.57
Memphis	94.3	95.7	96.7	2.63	86.1	87.5	89.1	2.29
Milwaukee	93.9	94.8	95.3	2.50	84.4	85.6	88.7	2.32
Minneapolis	92.2	92.5	94.3	2.41	84.6	85.0	86.2	2.08
Montreal	92.5	92.7	94.3	2.46	87.9	89.1	88.7	1.53
Nashville	94.8	96.0	96.8	2.70	86.4	88.0	88.6	2.57
New Orleans	94.4	96.3	96.8	2.92	86.6	87.7	88.6	2.49
New York	94.0	96.1	96.6	2.48	88.7	89.8	90.6	2.27
Omaha	92.0	92.2	93.9	2.67	84.3	85.0	86.4	2.40
Philadelphia	94.5	96.5	96.8	2.07	89.4	90.2	90.7	1.95
Pittsburgh	94.3	96.0	96.1	2.33	88.9	89.7	90.4	2.38
St. Louis	92.0	93.6	94.0	2.46	84.0	85.9	86.0	2.55
Salt Lake City	89.6	90.1	90.8	1.41	81.3	81.6	82.4	1.70
San Francisco	92.9	94.5	95.7	2.52	84.2	85.0	86.3	1.35
Seattle	92.0	94.2	95.0	2.43	83.5	85.5	85.8	1.47
Shreveport	94.6	95.9	96.6	2.81	85.0	87.5	88.2	2.76
Spokane	92.2	94.0	95.5	2.32	84.4	84.4	86.4	1.35
Toronto	92.6	93.8	94.2	2.55	88.2	88.4	88.4	1.45
Tulsa-Oklahoma City	92.2	93.0	93.8	2.59	84.5	85.6	85.9	2.04
Vancouver	90.9	92.7	93.9	2.70	83.7	84.6	85.2	2.30
Wichita	91.2	92.1	93.6	2.30	84.1	84.6	85.7	1.76
Winnipeg	92.0	92.1	93.1	2.27	85.6	86.0	86.0	1.86

WILMINGTON, Del.—Regular gasoline moved up 0.9 of an octane number and premium gained 0.8 in the second quarter of this year. In the past year, regular and premium increased by exactly the same amount, 2.1 octane numbers.

The unweighted average for premium in 48 typical cities and areas of this country and Canada was 94.9 octane on July 1 compared with 92.8 a year ago and with 91.0 for July 1953. The latest average for regular was 87.4 octane compared with 85.3 a year ago and 84.4 in 1953. These averages are from data compiled by the chemicals division of E. I. du Pont de Nemours & Co.

The trend toward higher-octane premium during the second quarter seems to have been influenced as much by gains in cities that rank just under the top as by the record breakers. This was not the case in the first quarter.

Ethyl Corp.'s survey of octane ratings for July shows a weighted average of 95.8 for premium and 88.5 for regular, based on samples from 53 marketing centers in this country.

The higher averages on the Ethyl survey are due in part to the fact that it is limited to cities in this country. The Du Pont survey includes six cities in Canada, all with premium averaging less than the national average for this country and four with regular falling below the average in the United States.

The unweighted July average for premium for the 42 cities of this country covered by the Du Pont survey was 95.2 octane. Regular averaged 87.6.

The Ethyl average also gives more weight to those cities in areas of high gasoline demand. Since the high-demand areas on the East Coast and Gulf Coast have the highest octane and gasoline, the weighting method tends to raise the national average.

For the 39 cities covered by both reports, the unweighted averages are almost the same. Premium in these cities averages 95.13 octane from the Ethyl report and 95.22 from the Du Pont survey. For regular, the Ethyl report shows an average 87.48 octane for the 39 cities and the du Pont survey shows 87.58.

GENERAL COMPARISONS*

	July 1953	July 1954	Apr. 1955	July 1955
Premium—				
Research Oct. No.	91.0	92.8	94.1	94.9
TEL content (cc. per gal.)	2.39	2.43	2.30	2.46
Regular—				
Research Oct. No.	84.4	85.3	86.5	87.4
TEL content (cc. per gal.)	2.12	2.19	1.94	2.13

*Unweighted averages of 48 cities or areas.

Rank Wildcat Hits

Most important '55 strike in the Rockies is the tag given Montana test; it extends Mississippian trend into U.S.

CUT BANK, Mont.—Union Oil Co. has what may be the year's most significant discovery in the Rocky Mountains.

The test is the 1 Otter Woman Morning Gun, and it may develop as Montana's most important strike since the discovery of Poplar field in 1951.

Initial tests indicate Union's well, in the Glacier Park area of Glacier County, will touch off a flurry of deep exploration.

The wildcat extends the Mississippian trend of wet-gas production from the Foothills Belt of Canada across the U. S. boundary line into Montana.

First tests recovered gas at the rate of 6,000 M.c.f. per day and 250 bbl. of distillate. The flow was from a 40-ft. zone at 8,962-92 and 8,998-9,008 ft. The operator will test lower zones before completion.

Second wildcat drilling . . . Union is already under way at 1 Mittens in Pondera County's Heart Butte area, 12 miles southeast of Morning Gun.

The discovery is 15 miles west of the south end of the big Cut Bank oil field. It is situated on the Disturbed Belt, the United States extension of the Canadian Foothills Belt. These foothills, ranging in width from 15 to 45 miles, stretch more than 1,100 miles along the eastern side of the Rockies from the Northwest Territories down to southern Montana.

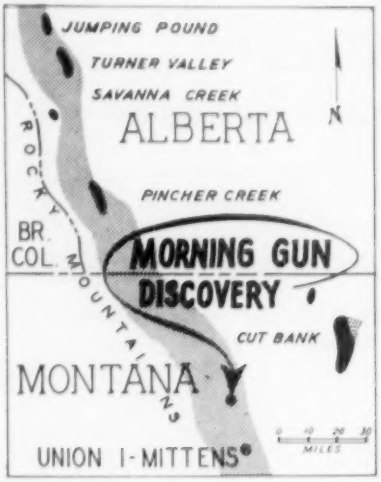
Morning Gun is 65 miles southeast of Pincher Creek, the biggest gas-distillate field in Canada and perhaps the largest shut-in field of its type in the world.

Production of the vast reserves, calculated to be 2.4 trillion cubic feet of raw wet gas, is being held up until a market is found for the dry gas. The field was discovered in 1947.

Montana's Disturbed Belt has had little previous drilling. The only prior deep test was the Carter-Union 1 Tribal in 1954. It was a dry hole.

Foothills play is big . . . The Foothills Belt is receiving the biggest exploration play in Canada. There has been sporadic drilling in the belt for three decades, but interest began building toward its present peak in 1955. Now oil companies have grabbed up leases over most of the belt.

There are four Mississippian wet-gas fields on the Canadian side—Brazeau, Jumping Pound, Turner Valley, and Pincher Creek. Turner Valley, with both oil and gas production, was Alberta's first oil field and is still the only oil production in the Foothills Belt.



The Mississippian wet-gas trend now extends some 350 miles from Brazeau in northwestern Alberta to the Morning Gun. The only production yet found in the mountains proper is at Savanna Creek in Alberta.

Numerous seepages in the area have attracted oil men more or less for several years. But the high cost of drilling the 10,000 ft. or deeper to the Mississippian, and the low discovery rate have discouraged exploration.

Leases Assigned Numbers

AUSTIN, Tex. — Beginning August 1, each oil and gas lease in Texas Railroad Commission District 8 in West Texas has a number. This number must be placed on each individual lease record or report filed with the commission.

The lease-numbering system will be extended to other commission districts soon. It was adopted to clear up confusion in record-keeping.

Las Animas Arch Opened

DENVER.—The first discovery on the Las Animas arch, which divides the Denver - Julesburg and Anadarko basins, has been completed 10 miles northeast of Las Animas in Bent County, southeastern Colorado.

The well, M. J. Stansbury's 1 Cordes & Oberlander, opens Beacon field. It was dually completed in the Atoka and Morrow sands of Pennsylvanian age. The discovery flowed 50 bbl. of oil daily from perforations in the Atoka at 4,619-31 ft. and 400 M.c.f. of gas per day from 5,203-27 ft. in the Morrow sand. Both zones were fractured.

A confirmation test has been staked 1 mile southwest by Western Natural Gas Co.

Gulf Zones Tapped

Mecom gets twin pay in test off Louisiana coast

HOUSTON.—Mecom Petroleums, a recently organized limited partnership, has tapped two new producing horizons in a well off the Louisiana coast.

The producer is Mecom's A-4 State Lease 1133, in Block 45, West Cameron area. It flowed 266 bbl. of 36.6°-gravity oil through 10/64-in. choke from perforations at 8,640-50 ft. From another zone at 8,600-06 ft., the well tested 3,882 M.c.f. of gas and 61.8 bbl. of distillate per day through ¼-in. choke.

Operator dually completed the well in both zones. Two other gas-producing horizons also were tapped.

Mecom Petroleums was formed last month by John W. Mecom, Houston independent oil operator, and San Jacinto Petroleum Corp. *(The Oil and Gas Journal, July 11, page 98).*

Mecom acquired the offshore lease on a farmout from Stanolind Oil & Gas Co. which retained an override. Besides the acreage, he obtained a drilling platform and equipment which allowed him to procede immediately with drilling operations. Stanolind had drilled four wells in the same area. Two were oil producers, another was a gas well and the fourth was abandoned. The new producing horizons, however, are about 900 ft. below the Stanolind tests.

Mecom's new well is about 6½ miles offshore and due south of Johnson Bayou field. The partnership has leases on all of Block 45 and the north half of the adjoining Block 56.

Pure Oil Co. also reported a gas discovery in the West Cameron area last week. The 1-A State Lease 1438, in Block 99, had a small flow of gas from a shallow zone at 1,707-09 ft.

The well was shut in after flowing 210,000 cu. ft. of gas per day on a test through 8/64-in. choke. It was drilled to 12,900 ft., but a company spokesman said it found no commercial shows at deeper levels.

Imports Keep on Rising

Trend expected to continue through year as firms again hike third-quarter estimates; crude now is 764,400 bbl. daily

AUSTIN.—Crude-oil imports are continuing their upward trend right through the year. This became more apparent last week when importers for the second straight month raised their estimates of crude hauls for the third quarter.

The importers now have increased their third-quarter crude estimates by 24,200 bbl. daily in 2 months. At the same time they cut product-import plans by 8,700 bbl. daily.

At the middle of May, companies reporting to the Texas Railroad Commission planned crude imports averaging 740,200 bbl. daily for the third quarter. On the latest reports to the commission, they had raised estimates of crude to 764,400 bbl. daily. Estimates of third-quarter product imports dropped from 269,200 bbl. daily to 260,500 bbl. daily.

The latest estimate of crude imports for the third quarter represents an increase of 15.3 per cent over actual imports reported by these companies for the same quarter last year.

Crude imports for the first quarter gained 17.8 per cent over the first quarter of last year. The gain dropped to 13.3 per cent for the second quarter. Now the company forecasts bring the increase for the third quarter back up to 15.3 per cent.

The decrease in crude imports in May and the large percentage gain in June were due to irregular lifting schedules.

Here's Crude Import Picture In Detail

(Thousands of barrels daily)

	Actual*		Estimated or forecast*				
	June 1954	June 1955	July 1955	Aug. 1955	Sept. 1955	Oct. 1955	Nov. 1955
CRUDE—EAST COAST:							
Atlantic Refining Co.	62.1	57.7	61.6	61.6	61.6	61.6	61.6
Cities Service Co.	13.5	30.6	45.5	28.3	32.2	28.3	28.5
Eastern States Petroleum Co.		40.3	20.5	20.0	20.0	20.0	20.0
Gulf Oil Corp.	128.0	109.0	116.0	113.0	114.0	114.0	114.0
McBride Oil & Gas Corp.	3.6	3.3	3.2	6.4	6.7	6.5	6.7
Phillips Petroleum Co.	6.6	17.3	9.7	9.7	10.0	9.7	10.0
Sinclair Oil Corp.	66.4	77.8	66.0	66.0	66.0	66.0	66.0
Socony Mobil Oil Co.	87.4	76.2	66.0	64.0	64.0	64.0	64.0
Southwestern Oil & Refining Co.		7.6	7.1	6.8	7.3	3.6	¶5.0
Standard Oil Co. of California	77.8	82.2	72.8	72.8	72.8	72.8	72.8
Standard Oil Co. (Ind.)	13.3	20.3	17.0	16.3	16.9	16.9	17.0
Standard Oil Co. (N. J.)†	79.0	84.0	79.0	79.0	79.0	79.0	79.0
Sun Oil Co.	7.5	30.2	24.5	35.2	24.2	31.4	28.3
The Texas Co.	44.9	69.2	66.8	70.2	68.1	43.2	65.7
Tide Water Associated Oil Co.	4.2	11.1	15.8	14.8	16.4	15.3	12.1
Total East Coast	594.3	716.8	671.5	664.1	659.2	632.3	650.7
CRUDE—WEST COAST:							
Shell Oil Co.				15.8	23.3	22.6	23.3
Socony Mobil Oil Co.		23.1	27.0	27.0	27.0	27.0	27.0
Standard Oil Co. of California	6.8	8.9	18.3	18.3	18.3	18.3	18.3
Tide Water Associated Oil Co.	11.8	26.8	29.4	32.8	19.0	18.7	18.7
The Texas Co.	4.6	4.0	21.0	10.3	10.7	11.4	12.0
Total West Coast	23.2	62.8	95.7	104.2	98.3	98.0	99.3
Total crude	617.5	779.6	767.2	768.3	757.5	730.3	750.0
PRODUCTS:							
Asiatic Petroleum Co.	11.3	14.9	4.7	4.5	8.0	7.0	4.5
Eastern States Petroleum Co.	16.0	19.4	17.3	17.3	17.3	17.3	17.3
Gulf Oil Corp.	8.0	8.0	11.0	8.0	7.0	7.0	7.0
Shell Caribbean Petroleum Co.‡	83.0	80.0	72.0	72.0	93.0	113.0	117.0
Shell Oil Co.	14.6	18.1	26.0	18.5	20.3	18.4	20.9
Sinclair Oil Corp.	3.5						
Socony Mobil Oil Co.	10.4	6.5	10.7	10.7	10.7	10.7	10.7
Standard Oil Co. (Ind.)§		4.8	14.9	10.8	18.3	19.4	25.0
Standard Oil Co. (N. J.)‡	122.0	155.0	103.0	103.0	103.0	179.0	179.0
Total products	268.8	306.7	259.6	244.8	277.6	371.8	381.4
Total crude and products	886.3	1,086.3	1,026.8	1,013.1	1,035.1	1,102.1	1,131.4
Bonded fuel included‖	73.7	102.1	76.3	76.1	79.7	74.6	72.2

*From company reports to the Texas Railroad Commission. †Based on quarterly estimates. ‡Imported by independent distributors. §Received through suppliers who can furnish either domestic or foreign oil. ¶Unreported by company, but an average of 5,000 bbl. daily is included in the total. ‖Mostly duty free for bunkering ships in foreign trade.

CRUDE IMPORTS*

(Thousands of barrels daily)

	1954	1955	Per cent change
January	600.8	716.8	19.3
February	609.1	747.3	22.7
March	642.3	721.4	12.3
First quarter	617.7	729.9	17.8
April	571.8	669.4	17.1
May	723.5	721.7	—0.2
June	617.5	779.6	26.3
Second quarter	638.5	723.5	13.3
July	678.8	767.2	13.0
August	654.2	768.3	17.4
September	656.0	757.5	15.5
Third quarter	663.1	764.4	15.3
October	656.1	730.3	11.3
November	626.0	750.0	19.8

PRODUCT IMPORTS*

(Thousands of barrels daily)

	1954	1955	Per cent change
January	450.5	508.1	12.8
February	482.6	519.0	7.5
March	346.9	451.8	30.2
First quarter	424.8	492.0	15.8
April	301.0	356.9	18.6
May	272.2	327.1	20.2
June	268.8	306.7	14.1
Second quarter	280.6	330.2	17.7
July	254.9	259.6	1.8
August	218.1	244.8	12.2
September	247.8	277.6	12.0
Third quarter	240.2	260.5	8.5
October	328.2	371.8	13.3
November	414.2	381.4	—7.9

*From company reports to the Texas Railroad Commission. Data for July-October are company forecasts.

Peak crude imports for 1954 by the companies came in May, but the record month so far this year was June.

Actual crude imports reported for the first 6 months of the year plus company estimates for the period from July through November show a gain for the first 11 months of 12.2 per cent. On the same basis, product imports will be up 11.8 per cent.

Crude imports by companies reporting to the commission accounted for 98.1 per cent of total crude imports tabulated by the Census Bureau for the first 5 months of this year. Company reports of product imports represented only 80.2 per cent of total product imports.

Company reports show an increase in imports of crude from Canada, starting with August. This additional crude will be for a new refinery in Washington. The volume of new Canadian crude is expected to average about 23,000 bbl. daily by the end of the year. By November of this year, 13.3 per cent of total crude imports will be for refineries on the West Coast.

Truckers Hike Rates

Texas drilling contractors begin paying new tariffs this week for moving portable rigs of more than 80,000 lb.

DALLAS.—Texas drilling contractors were hit by a hard right to the pocketbook last week.

Starting this week, contractors will pay higher rates to truck a portable drilling rig weighing more than 80,000 lb. The new trucking rates, approved by the Texas Railroad Commission, will take effect August 5.

The old and new rates applied to an actual move illustrate how big a jolt the new rates are. A trailer-mounted rig weighing 117,540 lb. recently was moved 203 miles to a new location. The contractor was charged $334.60. Under the new rate, he would have paid $677.60—roughly 202 per cent of the old charge.

The new rate schedule duplicates the old up to rig weight of 80,000 lb. Under the old rate there was a fixed charge of 80 cents a mile for moving portables weighing over 50,000 lb. The new rate calls for an 80-cent a mile charge for portables weighing 50,000 to 80,000 lb., $1.15 for rigs weighing 80,000 to 110,000 lb., $1.50 for rigs between 110,000 and 140,000 lb., and $1.75 a mile for rigs weighing over 140,000 lb.

The new schedule increases the "light" charge for heavier units accordingly. Light charges—the charge for the empty return trip from a move—will go up from the present fixed 60 cents a mile for units over 50,000 lb. to a new high of $1.55 a mile for those over 140,000 lb. There is a 95-cent a mile charge for rigs in the 80,000 to 110,000-lb. class and a $1.30 charge for those weighing between 110,000 and 140,000 lb.

Why the change . . . The rate hike will not affect moving bills of rigs not mounted on trailers.

Rigs are moved under two different sets of rates in Texas. Portables are charged on one scale (Item 110) of the Texas Motor Freight Commodity Tariff No. 6-C. Nonportables, where truckers must furnish trailers or semitrailers, pay a higher rate under Item 75.

When portable rigs started to become a factor in the drilling business, the Texas Railroad Commission in 1946 established the Item 110 rate schedule, recognizing that a rig owner should not be charged as much for a move if he furnished his own trailer.

Truckers wishing to move rigs under this schedule were issued special permits. So far 9 trucking firms out of roughly 240 carriers operating in the state have such permits.

Who benefits . . . These firms, represented by the Oilfield Haulers Association, Inc., and the Specialized Motor Carriers Association, successfully appealed to the commission for higher rates.

The truckers pleaded hardship. When Item 110 was set up, they said, portable rigs were small. Since 1946 they have been getting larger and heavier. Also, such moves now include many types of machinery not originally intended to be moved. The 110 rates, especially for weights over 50,000 lb., aren't high enough to pay a profit, they contended.

The commission turned down the truckers' proposal that they be allowed to charge the higher Item 75 rates for moving portables. From the higher rate, 15 per cent of total weight of the portable unit would have been deducted as the weight of the rig owner's trailer equipment.

The commission reasoned that this proposal would permit the trucker to make use of the contractor's trailer equipment for nothing and free him of buying and maintaining his own.

It did, however, agree that moving rates were too small on the heavier portables and ordered a higher schedule into effect. Higher rates were opposed by the American Association of Oilwell Drilling Contractors and by one member of the haulers' association.

Old Texas Line Relaid

LAREDO, Tex.—United Gas Pipe Line Co. has completed re-laying a 14-mile stretch of the second oldest natural-gas pipeline in Texas.

The line is the company's 8, 10, and 12-in. carrier extending from Laredo east to Pescadito Junction. It is being replaced with 12-in.

When the old line was completed in 1910, there was only one other carrying natural gas in Texas—a 6-in. line from Caddo field to Marshall, Tex. This one also later became a part of the United Gas pipeline system.

The Laredo line was laid from that city to the Reiser ranch 22 miles to the east. Gas was discovered on the ranch in 1908. The line, originally 8-in., was built by Border Gas Co.

Last major repair work was in 1931.

Idaho Is No. 31

State is first this year added to producers' list

PAYETTE, Idaho.—Idaho has officially become the thirty-first producing state in the United States by the thin geographical margin of 6½ miles.

Oroco Oil & Gas Co.'s 1 Johnson was completed for 400 M.c.f. of gas per day, making Idaho the first new producing state of 1955.

Three states joined the list last year, all of them by virtue of Shell Oil Co. discoveries. They were South Dakota, Nevada, and Arizona.

Idaho's discovery is 7½ miles southeast of Payette near the Oregon border on the route of the Pacific Northwest Pipeline. Production is from 1,379-1,422 ft., and the well is now shut in.

Another test is due at 1 Daws 14 miles south of the discovery well in the Fruitland area. Tests are pending at the 1 Carpenter, another discovery prospect 4½ miles northwest of 1 Johnson.

The new strike is in the Vale-Ontario basin. Several wells in the area have gas shows. But the unconsolidated formations have been a barrier to operators seeking to open gas production on a commercial basis in the eastern Oregon-western Idaho region.

A likely candidate to become the thirty-second producing state is Oregon. It almost made the grade in March. Oregon's prospect that fizzled was Oroco Oil & Gas Co. and J. R. Simplot Co. 1 Bolles. The wildcat was located in Malheur County near the Idaho line, just west of the 1 Johnson discovery.

The 1 Bolles blew out during tests and was later abandoned.

New Survey Ordered

Clareton study to determine best recovery possibilities

CHEYENNE, Wyo. — Another engineering study of the Greater Clareton field in Wyoming, the second this year, has been ordered by the State Oil and Gas Commission.

The new survey will determine whether water injection or repressuring should be used in lengthening productive life of the field.

An earlier study made by Core Laboratories, Inc., singled out wells in the field producing in excess of 5,000 cu. ft. of gas per barrel of oil. W. L. Horner, Core vice president in charge of reservoir engineering, reported of the 608 wells checked, 135 were found to be excessive producers.

The commission ordered all over-the-limit gassers shut in. The order, scheduled to expire July 31, has been extended until August 20. Commission members explained this action was taken to allow an unnamed gas company to decide if it will construct a gas-processing plant in the field at a cost of several million dollars. A decision is expected by August 13.

Horace Thomas, state geologist, said the company's interest in the field was aroused when the Core Laboratories survey indicated a larger gas potential than expected. Thomas added wider conservation practices could increase oil production at least 20 per cent, representing an extra $36 million income.

The geologist reported the unidentified gas firm already has signed up operators for the delivery of 22,500,000 cu. ft. of gas daily. It would be processed at a plant near Newcastle and the residue gas marketed through a system yet to be developed.

Voss Oil Co. recently announced it had purchased a processing plant in Oklahoma and would move the unit to the Clareton field. The Greater Clareton Producers Committee, headed by independent James P. Sloss of Denver, also is considering constructing one or more plants in the field.

Merger Plans Announced

DENVER. — Stockholders of two Rocky Mountain oil firms will vote August 22 on a proposed merger to take effect August 31. The companies are Empire Petroleum Co., Denver, and Western Empire Oil Co., Thermopolis, Wyo.

E. M. Stone, president of Empire Petroleum, said that Western Empire would be merged into his Denver company. Holders of Western Empire stock would receive one share of Empire for four shares of the Wyoming firm. H. O. Batzer is president of Western Empire and mayor of Thermopolis.

Empire operates a 7,000-bbl. refinery in Denver. Western Empire owns or has interest in 30 producing wells in Weston County, Wyoming, and undeveloped acreages in Wyoming and Montana.

Aluminum Oil Pipe Designed

OAKLAND, Calif.—A new aluminum pipe which may compete with steel in above-ground oil field use has been designed by Kaiser Aluminum & Chemical Corp.

Kaiser announced the pipe comes in 2, 3, and 4-in. diameters. Base price is 23 cents a foot for 2-in. size, 40 cents for 3-in., and 60 cents for 4-in. pipe. It is formed by rolling aluminum sheet and welding the seam instead of by an extrusion process.

Kaiser claims the new pipe has advantages of lower price, less weight, and ease of handling. A new kind of detachable coupler made of cast aluminum eliminates welding of the coupler. Two sections can be coupled by one workman using a spanner wrench. The couplers are designed to permit the pipe to curve around obstacles and follow ground surface over which it is being laid.

Writeoffs to End?

Humphrey says tax lure no longer needed for defense

WASHINGTON. — Tax amortization has served its purpose and now should be sharply curtailed, in the view of Treasury Secretary Humphrey.

He said quick writeoff of investment should be limited to the building of plants for goods that would be a "must" in wartime, cannot be secured from present plants, and where government contribution is necessary to attain production goals.

Humphrey gave his views while appearing before a House government operations subcommittee which is studying the amortization program.

Humphrey pointed out that the excess profits tax, which took up to 82 per cent of corporation profits and tended to discourage spending for new plant, has been repealed. Liberalized depreciation under the 1954 tax law now permits faster capital recovery.

Accelerated amortization will cost the Treasury $880,000,000 in revenue this year, Humphrey said.

In nearly 5 years, the amortization program has spurred almost 20,000 projects costing $30,500,000,000. Close to $4,400,000,000 of this has gone to expansion of the oil and gas industry.

Kefauver ponders the idea . . .

Controls for Crude Lines, Too?

WASHINGTON. — Should crude-oil pipelines be regulated by the federal Government?

This question was raised by Sen. Estes Kefauver of Tennessee during a hearing on the controversy boiling around a Glendive, Mont., to Guernsey, Wyo., pipeline project.

Kefauver said testimony might pose the question of whether federal control of natural-gas pipelines should be extended to crude and products lines.

Shell Oil Co. was accused by an Atlanta, Ga., promoter last week of trying to block his proposed pipeline by signing up producers for a parallel line.

Shell denied the charges of antitrust law violations, leveled by Wiley L. Moore, chairman of Ar-Mex Pipeline Co. Moore told the Senate antimonopoly subcommittee the Shell line would cause him to lose $100,000 he has spent on the project to carry crude oil from eastern Montana.

Moore said he had gone ahead with his plans only to have Shell announce its own pipeline and line up large producers whose crude he had hoped to transport.

"It looks to me like they are trying to monopolize all the oil transportation and all the other oil business in the country," Moore told the subcommittee.

Dene Hodges, Shell vice president, testified that his company and others began considering the Montana-Wyoming pipeline from the western area of the Williston basin a year before Moore mentioned his project *(The Oil and Gas Journal, September 21, 1953, page 152 and December 21, 1953, page 112)*. He said a monopoly would be impossible because the pipeline would have to be a common carrier under Interstate Commerce Commission regulation.

The Butte line, which is under construction, is owned by Shell, Murphy Corp., and Northern Pacific Railroad.

The $22-million project planned by Moore is part of an 1,800-mile system which Ar-Mex had hoped to build across the Rockies into Colorado, Arizona, New Mexico, and Texas *(The Oil and Gas Journal, September 13, 1954, page 91)*. Developments since plans were announced almost a year ago have made the construction doubtful.

War Pipeline Reviewed

But evidence indicates Government will refuse subsidy, killing L. M. Glasco's plans for Texas-California line

WASHINGTON.—The Joint Chiefs of Staff will be asked to take another look at the need for an emergency war line to carry Texas crude oil to the West Coast.

But there is no indication the Government will change its mind and decide the line is essential—paving the way for a federal subsidy on the $106,500,000 project proposed by West Coast Pipe Line Co.

The House armed services subcommittee wound up hearings last week into the adequacy of West Coast crude supplies for an emergency. Chairman F. Edward Hebert of Louisiana said the joint chiefs would be asked for a fresh review of the situation. The subcommittee will side with the military when it reports the results of the extensive hearings.

But the long odds against the 1,030-mile, 24-26-in. line were pointed up by secret testimony of Defense Mobilizer Arthur Flemming whose views were made public by the congressmen.

Flemming joined Hugh A. Stewart, director of the Office of Oil and Gas, in the Interior Department, and Brig. Gen. W. W. White, staff director of the petroleum logistics division of the Defense Department, in opposing government backing for the project (*The Oil and Gas Journal July 18, pages 68-69*). Flemming made these points:

. . . **Crude production capacity** in California increased considerably since World War II and will meet California refinery requirements in wartime.

. . . **A products line** to be in operation this year can be used in an emergency to transport Texas crude to California if Canadian crude can't be imported by tanker.

. . . **Pacific Northwest** refinery needs can be supplied from Canada through the Trans-Mountain Pipeline.

. . . **Any temporary shortage** of refined products on the West Coast could be relieved in part by shipments via the Southern Pacific Pipeline. The remainder designated for rail movement is too small to warrant government aid for a pipeline.

Some of these contentions were disputed by Lowell M. Glasco, Dallas, president of West Coast Pipe Line Co. He based his arguments for the pipeline he has been promoting since 1944 on these principal points:

. . . **Increased demand** for oil products in California.

. . . **The possibility of atomic** or H-bomb attacks on the West Coast.

Glasco told the subcommittee civilian demand for products in District V reached 983,442 bbl. daily the first 4 months this year, up 24.4 per cent from 1950 and 80,000 bbl. daily above the average a year ago.

He said demand was certain to climb substantially higher because of the growing population in the five states. Their 1950 population of some 15 million will rise to almost 22 million by 1960 and approach 25 million in 1965, Glasco said.

Challenging testimony of previous witnesses that supplies were adequate, he asked:

"Why is it necessary to import . . . 53,000 bbl. of foreign crude, plus large additional amounts of natural gas, gasoline, and lube stocks from the Gulf Coast? The uncontradicted fact that California now imports crude in peacetime should not encourage faith in the sufficiency of their supply in wartime."

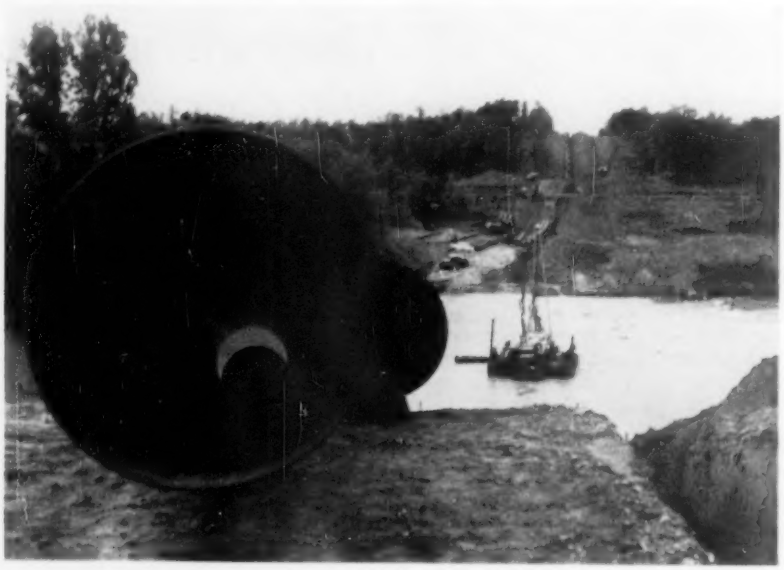
Hebert wanted to know why, if the pipeline is feasible economically, Glasco needs federal financial aid to build it. Glasco said he could not get private capital.

Hebert asked whether Glasco had commitments from refineries to take the crude. He first replied he did not. But under insistent quizzing, Glasco said that even without the aid of major oil companies, enough refinery capacity would be built to use the 400,000 bbl. daily which his line would be designed to carry.

He could not name names, he said, "because people would have their water turned off." Prodded still further, he said he could furnish subcommittee members privately evidence of a use for 60 per cent of the oil the pipeline could carry.

TIPRO wants pipeline . . . A statement from the Texas Independent Producers and Royalty Owners Association favoring a Texas-to-California crude line was entered into the record. TIPRO did not endorse Glasco's pipeline. But it said such a pipeline "will serve the best interests of our industry, our state, and our nation."

TIPRO declared "there is readily available in Texas more than sufficient crude oil" to supply the line. The association expressed hope that the hearings "will point up that at least part of the opposition comes from those whose underlying objective is to promote increasingly excessive imports."



Super-Inch Pipe Crosses River

This giant, 36-in. pipe soon will be buried under the Tallapoosa River in Alabama. It is part of the 315 miles of 36-in. pipe being laid along Transcontinental Gas Pipe Line Corp.'s big natural-gas system between Texas and New York. The barge in the middle of the river is used in drilling holes for blasting a ditch across the rocky bottom of the stream. Transco's expansion program also includes 219 miles of 30-in. and 57 miles of 12, 16, and 24-in. pipe parallel to the existing main line. The project will increase daily allocated capacity of the Transco system to 695,000,000 cu. ft. of gas, an increase of 130,000,000 cu. ft. per day. Construction is to be completed before the winter heating season.

Process Licensed

Grace will use Phillips' polyethylene development

NEW YORK—W. R. Grace & Co. has made its second big splash in the nation's petrochemical pool by becoming the first licensee of Phillips Petroleum Co.'s process for making polyethylene. *(The Oil and Gas Journal, May 2, page 53).*

The company said agreement includes use of the process and patent rights and the licensor's technical knowledge in producing the plastic.

Grace said it expected to spend $18,000,000 building the plant and that it planned to place it on stream in the first half of 1957. Construction will get under way early in 1956 after engineering studies have been completed and a plant site selected.

The company, through its subsidiary Grace Chemical Co., entered the petrochemical field in 1953 with the announcement of its ammonia plant near Memphis.

Even before the Memphis plant was completed in December 1954, company officials began dropping hints that Grace wasn't through with its petrochemical ambitions. However, at that time speculation was that the venture would have to do with other chemicals closely allied to the synthesis of ammonia from natural gas *(The Oil and Gas Journal, October 19, 1953, page 186).*

Humble Begins Arizona Test

WINSLOW, Ariz.—Humble Oil & Refining Co. has spudded the first of a series of wells planned in Arizona.

The wildcat, No. 1 Navajo Tribe of Indians, is in the northeast corner of Arizona. It is about a mile southwest of Shell Oil Co.'s East Boundary Butte discovery in Apache County.

The test is Humble's first venture in Arizona, where Shell established first commercial production last year. Shell's No. 2 East Boundary Butte, the discovery, flowed gas at the rate of 2,200 M.c.f. and oil at the rate of 11 bbl. per day *(The Oil and Gas Journal, November 1, 1954, page 58).* Shell's No. 1 East Boundary Butte recovered a smaller quantity of gas and had some oil shows but was not ranked as a commercial producer.

Humble announced plans for an extensive exploration program in the Arizona portion of the Four Corners area several months ago. Its first test is projected to 6,500 ft.

Shell's East Boundary Butte field is about 8 miles southeast of the Boundary Butte field in Utah.

UNION'S TORREY CRUDE begins its trip from this pump station near Santa Paula.

Land Route Pays Off for Union

LOS ANGELES.—Union Oil Co. was born in the 1890's in the Torrey Canyon field near Santa Paula, Calif., and over the past 65 years has moved many a thousand barrels of crude oil to the Pacific Ocean for the short tanker hop down to the Los Angeles refinery.

However, economics of the move finally dictated a change in plans, and late last year Union began building a 67-mile, 12-in. carrier to bring the oil across the high Sierras into the company's Los Angeles refinery.

Union figured 4½ cents a barrel could be saved by abandoning the old pipeline-tanker combination and going wholly by pipeline. The line, which has a capacity of 50,000 bbl. daily, was laid in 6 months.

Laying of the pipe was one of the fastest parts of the project. The company's lawyers had their hands full from the beginning with such items as securing 30 easements across private property, obtaining franchises for 40 miles of pipe laid along public thoroughfares, and arranging 125 permits from government authorities.

The company's financial experts, advised selling the line to another firm and then leasing it back on a monthly-payment basis for 25 years. So, though the line's actual owner is Santa Clara Valley Pipeline Co., it's Union's savings of 4½ cents a barrel.

C.I.O. Withholding Cash, So . . .

. . . Oil Union's Drive Bogs Down

DENVER.—Efforts of the Oil, Chemical and Atomic Workers International Union to step up organizing in the oil and chemical industries with C.I.O. cash has hit a snag.

O. A. (Jack) Knight, union president, declined comment on the possibility of C.I.O. President Walter Reuther's approving an appropriation to supplement O.C.A.W.'s expenditure for its membership campaign.

It was learned authoritatively, however, that Knight made a bid for the money at a recent meeting of the C.I.O. executive board in Washington and came away empty handed. He was told there would be an indefinite delay in any all-out drive pending further advancement of the C.I.O.-A.F.L. merger.

Also bogged down was a plan to name a C.I.O. organizing committee, including Reuther, to help O.C.A.W. in its long-expected campaign. Knight had hoped the group would be formed at the Washington meeting. But no action was taken and there were no indications when it could be expected.

Knight refused to name the companies at which the proposed organizing drive would be aimed. But he had said earlier immediate O.C.A.W. organizing would be directed at Standard Oil Co. (N.J.) and Du Pont.

Failure of C.I.O. to come across with monetary or physical aid left O.C.A.W. engaged in only one large-scale membership campaign — at the Standard Oil Co. (Ind.) refinery at Whiting, Ind. The union last January began to raid the Independent Petroleum Workers of America there of its 6,500 members. O.C.A.W.'s announced goal is to sign up two-thirds of the workers before December, 1955, so it can petition for a National Labor Relations Board representation election when the independent union's contract expires.

Merger Has New Angle

Monsanto Chemical-Lion Oil union will see oil company become division of chemical concern for the first time

EL DORADO, Ark.—There's something new in the industry as a result of the merger of Lion Oil Co. and Monsanto Chemical Co.

For the first time, an oil company will become a division of a chemical concern.

Lion will retain its full identity but will be known as a division of Monsanto if the merger is approved by stockholders September 23.

The union, to be effective September 30, will considerably strengthen Monsanto's competitive position. The St. Louis firm not only will gain diversification by getting into the oil business. It will secure a ready supply for much of its raw materials.

Monsanto, the nation's sixth largest chemical company with assets of $376 million, is a big consumer of petroleum fractions and natural-gas products in its manufacturing operations. Apart from fuel and power, more than half its raw materials come from these products.

Lion, whose holdings are valued at $147 million, is an integrated oil company with a strong chemical accent. More than half its investment and earnings is in petrochemicals. Lion is a large low-cost producer of nitrogenous chemicals — ammonia and its derivatives.

Perfect fit . . . The merger combines a large consumer of nitrogen with a major supplier. Their operations should mesh perfectly.

Lion is a well-balanced producer, refiner, and marketer of oil, in addition to having a production of 265,000 tons of nitrogen annually at its El Dorado, Ark., and Luling, La., plants.

Monsanto is a large producer of phosphorus and uses this element in combination with ammonia to produce concentrated fertilizers, for which the market is expanding. Its production of insecticides, herbicides, and other agricultural chemicals complement Lion's chemical activities.

Monsanto's phosphorus furnace in Idaho, expanded last year, is the largest in the world. The company also claims to be the only producer of all six major plastics—phenolics, styrenes, aminoplasts, vinyls, cellulosics, and polyethylene. Its new polyethylene plant at Texas City, Tex., has a capacity of 66,000,000 lb. per year.

Lion has been successful in the past in increasing its reserves of oil and gas, and owns undeveloped leases in 15 states. But the industry can expect the Arkansas company to move more toward manufacture of raw-material chemicals for Monsanto operations.

Stock exchange . . . Basis for the merger will be the issuance of 1½ shares of Monsanto $2 par value common stock for each share of Lion stock. Monsanto split its stock 3-for-1 July 11 and now has 15,851,901 shares outstanding. Lion has 3,090,915 shares.

Lion had earnings of $7,816,987, or $2.53 per share, the first 6 months this year while Monsanto profits were $16,409,680, or $1.02 per share on the new $2 par stock.

Charles Allen Thomas, who continues as Monsanto president, announced the board of directors planned to supplement the regular quarterly cash dividend of 25 cents a share with an annual stock dividend of 2 per cent. This is provided profits continue near the present level. The first stock dividend would be payable before the end of 1955.

Col. T. H. Barton and T. M. Martin, chairman and president of Lion, will become members of the Monsanto board.

T.G.T. to Let Long Line

HOUSTON.—Tennessee Gas Transmission Co. plans to award contracts early this month for construction of a 366-mile, 30-in. natural-gas pipeline along the Gulf Coast.

The line will extend from Agua Dulce, Tex., about 30 miles west of Corpus Christi, to Kinder, La. Construction is due to start before the end of the month. The $35,400,000 project is to be completed next fall.

Pipe is being produced by United States Steel Corp.'s Consolidated Western Steel Division at Orange, Tex. The plant is on a 24-hour-a-day, 6-day-a-week schedule to complete the job.

The 30-in. line will have a capacity of 270,000 M.c.f daily and will tie in with the south end of a 576-mile line built by T.G.T. last year between Kinder and Portland, Tenn. *(The Oil and Gas Journal, February 7, page 80).* When the new link is completed, T.G.T. will have a 30-in. line extending nearly 950 miles from South Texas to Tennessee in addition to its main transmission system between Texas and New England.

Williston Test Hits

Rothschild finds oil in important Montana wildcat

SIDNEY, Mont.—Another important strike was chalked up last week for the Montana portion of the Williston basin.

It is Rothschild Oil Co.'s 44-15 Northwest Improvement Co., an indicated Ordovician discovery in Fallon County.

Tests indicated the most important discovery in the area since the opening of Fertile Prairie field in 1954. It is east of the Cedar Creek anticline and could point the way toward exploration of the deep portion of the Williston basin lying between this anticline and the Fryburg area of North Dakota.

Drill-stem tests recovered 710 ft. of gassy oil at 9,441-41 ft.; 350 ft. of oil and gas-cut mud at 9,492-9,510 ft.; 620 ft. of muddy oil at 9,522-34 ft.; and 690 ft. of mud heavily cut with oil and gas at 9,566-88 ft. Rothschild was preparing to set pipe.

The new potential discovery is 7 miles southeast of Cabin Creek and 8 miles north of Pennel, a 1955 Ordovician strike. It is 14 miles north of Fertile Prairie, one of the exploratory highlights of late 1954.

Colorado Gas Line Killed

DENVER. — The Colorado Public Utilities Commission last week declared void a certificate it granted a year earlier to Colorado Western Pipe Line Co. to build 328 miles of natural-gas lines from La Plata County in southwestern Colorado to Pueblo, Colorado Springs, and Denver *(The Oil and Gas Journal March 1, 1954, page 119).*

Joseph Hawley, commission president, said the certificate was withdrawn because construction of the line had not been started within a year, as required by the commission.

Road Program Killed

Industry loses benefit of highway building, but escapes higher levies on gasoline, diesel oil, and truck tires

WASHINGTON. — The oil industry will not be burdened by stiffer road-user taxes during the next year. But neither will it enjoy the tremendous business impetus that would have come from a proposed multibillion-dollar federal-state highway program.

The House couldn't agree on how to finance a greatly expanded interstate road system and killed bills sponsored by both Republicans and Democrats last week. Spokesmen for both parties immediately declared the legislation to be dead for this session.

House Speaker Sam Rayburn said the bitter split between the Republican bond-issue plan and the pay-as-you-go automotive taxes offered by the Democrats might doom the bill next year, too.

The defeat of the Democratic bill was a surprise. The House voted 292-193 to reject the $50 billion program which would include $24 billion in federal aid for interstate superhighways over the next 13 years. The bill, introduced by Rep. George H. Fallon of Maryland, was approved by the House public works committee. Rayburn predicted it would pass.

Truckers howl . . . But a steady outpouring of protest, particularly from trucking interests, persuaded congressmen to turn down the sizable tax boost.

A straight party-line vote, 221-193, also defeated the substitute containing President Eisenhower's plan to help finance highway building by issuing $21 billion in 30-year bonds. They would have been retired by existing gasoline taxes.

The hitch, according to John W. McCormack, House Democratic leader from Massachusetts:

"Everybody wants a road bill and no one wants to pay for it."

Most congressmen agreed it was the heavy levies on the trucking industry that doomed the Democratic bill.

But 75 per cent of the money would have been raised by boosting the federal gasoline tax from 2 to 3 cents a gallon. Truck-size tires and tubes would have been taxed at 15 cents a pound instead of the present 5 cents. Taxes on diesel oil also would have been raised.

Gasoline tax "inequitable" . . . Oil industry spokesmen told the House public works committee the added taxes were inequitable *(The Oil and Gas Journal, July 18, page 74)*. Witnesses said gasoline taxes were already nearing the point of diminishing returns and that higher levies would put 12,000 jobbers and 200,000 dealers "into slavery until 1970."

Rep. Tom Steed, Oklahoma Democrat, said the loudest squawks came from the truck owners who are not in the freight business.

"You're stepping on the toes of too many little people," he said.

Although everyone agrees on the need for a road program, the prospects for one in 1956 are made doubtful by the fact it is on election year. Members are torn between the desire to go before constituents with a road program and the fear of facing them after raising taxes sharply.

The Senate rejected the Eisenhower plan and passed one of its own without providing for financing.

Sinclair Contract Approved

DENVER.—Union members of Sinclair Oil Corp. finally have ratified a new contract which C.I.O. Oil, Chemical and Atomic Workers Union negotiated with the company. The vote was 3,411 for and 1,281 against. About 5,000 of the 10,000 workers did not vote.

Following the voting, Union Vice President B. J. Schafer and representatives of Sinclair signed the contract in New York.

. Meanwhile, O.C.A.W. officials announced here they would use "the gains won" in the Sinclair agreement in negotiating future contracts with other oil firms. Union leaders reported the new contract provided gains in provisions covering pensions, life insurance, hospitalization, medical and surgical insurance plans. It also contained a 10-cent an hour wage increase retroactive to March 1 and other fringe benefits.

Pollution Warning Issued

AUSTIN, Tex.—Olin Culberson, a member of the Texas Railroad Commission, has warned operators in six fields of Stonewall, Haskell, and Knox counties, Texas, to stop disposing of salt water in surface pits.

Culberson said such storage is likely to pollute shallow fresh-water sands. He said he will inspect the fields September 1 to see if the commission order has been carried out.

Pipeline Briefs

SHREVEPORT.—Texas Eastern Transmission Corp. subsidiaries will begin work immediately on two expansion projects to increase capacity on both ends of Texas Eastern's Texas-East Coast line.

Wilcox Trend Gathering System, Inc., will expand capacity of its 157-mile, 20-in. line from Hagist Ranch field to Provident City, Tex., to 200,000,000 cu. ft. daily.

Texas Eastern Penn-Jersey Transmission Corp. will shift compressors to increase capacity east of the Oakford, Pa., storage reservoir to 853,000,000 cu. ft. daily.

WASHINGTON. — Stanmount Pipe Line Co. has received a rapid tax amortization for the portion of its line within the United States. The company proposes to build a crude-oil line from Tioga and Beaver Lodge oil fields in North Dakota to Cromer, Man., where it will connect with Interprovincial Pipe Line Co.'s system. The line will be a 70-mile, 10-in. carrier inside the United States. The writeoff called for $2,631,000 for the line and $278,000 for storage.

OKLAHOMA CITY.—Cities Service Gas Co. has received Federal Power Commission approval to begin an expansion program in Oklahoma and Kansas. The firm plans to build 238 miles of pipeline and add a 2,700-hp. compressor station to its system. The construction will cost $8,422,000. It will increase the line's capacity to 100,000 M.c.f. The new facilities will be placed in operation by January 1, 1956.

WASHINGTON.—Southern Natural Gas Co., Birmingham, Ala., plans to build 39 miles of loop lines and expand compressor stations on its pipeline system in Georgia and Louisiana. The project will cost $2,157,200. The deal is contingent upon purchase of 50,000,000 cu. ft. of gas per day from United Gas Pipe Line Co. of Shreveport, La. Both applications have been consolidated for hearing before the Federal Power Commission.

HOUSTON.—Transcontinental Gas Pipe Line Corp. plans to loop 27 miles of its system in Louisiana, Georgia, North Carolina, Virginia, and Maryland. The company has requested Federal Power Commission authority for the project. Transco asked fast approval so that it might include the construction in with work presently under way. The looping would cost $3,426,000.

Old Dome Pays Off

Texaco strikes oil around old Davis Hill salt dome

LIBERTY, Tex.—After 50 years of intermittent drilling, commercial production has been found on the old Davis Hill salt dome, 10 miles north of here.

The strike was hailed generally as one of the most interesting land exploration developments on the Gulf Coast in recent years. It was particularly significant to the large group of geologists and oil operators who for years have contended that no salt dome is unproductive . . . and no dome has yet been fully developed.

The discovery was made by The Texas Co. at its 4 Wirt Davis Estate, a deep test on the east flank of the dome, which, during initial tests through 5/32-in. choke, flowed at the rate of 185 bbl. of 46.1°-gravity oil per day. Flow was under pressure of 850 psi. with gas-oil ratio of 720 cu. ft. per barrel.

The well had been drilled to 9,106 ft. but production is from a sand perforated at 6,833-43 ft. It is the fourth test of Texaco's latest series of wildcat efforts started last year on this dome.

First of these four tests, 1 Wirt Davis Estate, was completed in June 1954 as a small dry-gas well from a 3,500-ft. sand. This was the first production of any kind on the dome, although some previous tests have had noncommercial production or promising showings of oil or gas.

Davis Hill, one of the Gulf Coast's oldest known salt domes, has been prospected since the early part of the century. Discovery as a salt dome dates from 1905. Since then numerous tests, mostly shallow, have been drilled in spasmodic exploration efforts.

Repressuring Stepped Up

OPELIKA, Tex. — Lone Star Producing Co. will expand its gas repressuring operation in the Rodessa lime of Opelika field in Henderson County.

There are seven injection wells in the 11,200-acre reservoir, which has been entirely unitized for gas. Lone Star Producing, the operator, plans to add three more inputs to inject 70,000,000 cu. ft. of gas daily into low-pressure areas of the field's big gas cap.

There are 20 wells producing distillate from the gas cap and 56 wells producing from the oil zone.

So far the field has produced 14,500,000 bbl. of 60°-gravity condensate and 5,600,000 bbl. of oil.

Siboney Stakes First Cuban Location

Drilling is scheduled to begin this fall on Siboney Development & Exploration Co.'s 2,569,840-acre concession in Cuba. Shown staking the first location are James C. Shields, left, geologist for Sterling Oil of Oklahoma, Inc., and R. B. Hurlbutt, right, geologist for Crescent Corp. (formerly Deep Rock). The two Tulsa firms organized Siboney and offered 2,000,000 shares of stock at $1 each to finance the program. Siboney is committed to drill at least 36,000 ft. of exploratory hole in Havana, Camaguey, Oriente, Las Villas, and Matanzas provinces. Siboney has an option until January 27, 1957, to acquire rights on an additional 2,652,658 acres. Concessions have been granted or applied for over virtually the entire island since the discovery of Echevarria field in Camaguey in May 1954.

Industry Briefs

ANACORTES, Wash.—Major process equipment is in place at Shell Oil Co.'s new 50,000-bbl. refinery here which will be supplied crude by a spur line of Trans Mountain Oil Pipe Line Co. Piping is the largest job yet to be completed before the plant goes on stream late this year. Process units at the plant include crude distillation, catalytic reforming, catalytic cracking, gas recovery, and catalytic polymerization.

EL DORADO, Ark.—Kin-Ark Oil Co. has increased its holdings in Union County, Arkansas. Curtis A. Kinard, president of Kin-Ark, said the company had acquired full oil rights to 10 producing leaseholds and had increased ownership in four other properties to 85 per cent. Eighteen wells located on the leaseholds are producing approximately 225 bbl. daily.

NEW YORK.—Thompson Chemical Co. has announced letting of a design and engineering contract to Scientific Design Co., Inc., New York City, for a polyvinyl-chloride plant to be built at New Dighton, Mass.

OKLAHOMA CITY. — Oklahoma's basic crude-oil production allowable will continue at 550,000 bbl. daily during August and September, unchanged from July. Nominations of purchasers included D-X Sunray Oil Co.'s 100,000-bbl. daily, the highest in Oklahoma proration history. D-X Sunray nominated 98,000 bbl. daily last month. Actual production is expected to be 555,000 bbl. daily because of new wells.

WASHINGTON.—The Interior Department has announced acceptance of all high bids in the July 12 sale of oil and gas leases on the Continental Shelf of Louisiana and Texas. The bonus total was $100 million, including $6,195,751 for 13 tracts in the disputed zone between the 3-mile and 3-league lines off the Louisiana coast.

BATON ROUGE.—Louisiana's oil-production allowable for August has been set at 691,981 bbl. daily. This is 8,355 bbl. per day more than last month's allowable, but Conservation Commissioner John B. Hussey said the increase is accounted for by new production. The allowable includes 63,983 bbl. daily for offshore production.

BIG SPRING, Tex.—Cosden Petroleum Corp. will begin construction here this year on an 18,000,000-lb. per year styrene plant. The unit, to cost $2,850,000, will use raw materials from the company's existing aromatics plant at its refinery. The styrene plant is scheduled to be completed next summer.

Plant Work Let

Pipeline to feed Canadian petrochem plant started

MEDICINE HAT.—Work will start soon on a $22-million petrochemical plant here which will operate on natural gas piped from Alberta's Etzikom gas fields.

Contracts have been let for units of the ammonia plant, which will be operated by Northwest Nitro-Chemicals, Ltd. Preliminary work already has begun on the $1-million pipeline which will bring gas from the Etzikom field.

The plant will manufacture ammonia, ammonium nitrate, ammonium phosphate, and nitric and sulfuric acids. Canadian Kellogg Co. has contracts to construct the ammonia, sulfuric-acid, and nitric-acid units. Fluor Corp. of Canada will build the phosphoric-acid unit. Prime contractor, Ford, Bacon & Davis of New York, will construct all off-site facilities.

Northwest Nitro-Chemicals is controlled by Commercial Solvents Corp. of New York with New British Dominion Oil Co., Ltd., Calgary, holding a substantial interest. The Etzikom gas field is owned approximately 65 per cent by New British Dominion and 35 per cent by Midcon Oil & Gas, Ltd. The same firms own South Alberta Pipe Lines.

Pembina Passes Leduc

EDMONTON, Alta.—North America's biggest new oil field is leading the way to Canadian production records.

Output from Pembina field reached a record-breaking 49,037 bbl. daily during the week ended July 18. This lifted Pembina above Leduc-Woodbend, the former No. 2 Canadian area at 47,973 bbl. per day. Redwater field, also in Alberta, remains No. 1 in Canada with 105,237 bbl. per day.

The week also saw two other new records in Canadian oil production. Alberta's average daily output from 5,494 wells rose to 368,219 bbl. daily. The province was responsible for Canada's new high of 402,225 bbl. daily.

Company to Move Refinery

CALGARY.—A refinery which has outlived its usefulness in one area will be moved to greener pastures by North Star Oil, Ltd., of Winnipeg, Man.

The company plans to move its 4,000-bbl. plant at St. Boniface, Man., to the Peace River sector of northwestern Alberta, where it can be utilized.

The 4,000-bbl. plant was made obsolete in St. Boniface by North Star when it recently went on stream with a new 12,000-bbl. refinery there.

The only other refinery move in Canada was made by Imperial Oil, Ltd., several years ago when it moved its Whitehorse, Yukon, refinery down the Alaskan Highway to Edmonton.

Petrofina Expands

Western Leaseholds bought by Belgian-owned company

MONTREAL.—Canadian Fina Oil, Ltd., is continuing the rapid expansion pace that has made the Belgian "Petrofina" subsidiary a major operator and marketer in Canada in less than 5 years.

The fast-growing company acquired another sizable block of leases and oil production in its latest deal—purchase of controlling interest in Western Leaseholds, Ltd. Canadian Fina, owned by Cia. Financiere Belge des Petroles, S.A., gained control of the Calgary-based independent from Eric L. Harvie for an undisclosed sum.

The deal was understood to involve a stock exchange at the ratio of 10 shares of Western Leaseholds for 3 of "Petrofina."

T. Nittescu succeeds Harvie as president of Western Leaseholds. Harvie remains on the board and also becomes a director of Canadian Fina.

Property involved . . . Western Leaseholds owns about 75 wells in Redwater and Vermilion fields of Alberta and has varying interests in 60 wells in Drumheller, Leduc, Excelsior, Samson, and Jener fields. These holdings were developed from a start of 250,000 acres of mineral rights taken by Harvie in lieu of legal fees. A large slice of the acreage turned out to be in Redwater field and the return has been around $120 million.

Through subsidiaries, Western Leaseholds owns an additional 693,000 acres in Saskatchewan and 529,500 acres in Manitoba. Prairie Leaseholds, a wholly owned subsidiary, has drilled one producing well and another indicated producer in initial development of freehold acreage in Midale field, southwestern Saskatchewan.

Other deals . . . Petrofina has grown by leaps and bounds since entering the Canadian oil picture in 1950. It has gained control of Calvan Consolidated Oil & Gas Co., Ltd., and a working interest in Great Plains Development Co. of Canada, Ltd. From Calvan the company got 5,000,000 additional acres on the prairies, and the other deal gave Petrofina production from 50 wells and a large block of acreage in Pembina field.

The company is building a 20,000-bbl. daily refinery costing $20,000,000 at Montreal. Through purchases and construction, it has built up a chain of almost 1,000 service stations across Canada.

Canadian Briefs

CALGARY.—Westcoast Gas Transmission Co., Ltd., now has until November 30 to show all financial arrangements have been completed for its gas line from the Peace River area to the West Coast. The Alberta Petroleum and Natural Gas Conservation Board granted the extension from July 15 to November 30. This was necessary to give Pacific Northwest Pipeline Corp. time to get permission of the U.S. Federal Power Commission to import the gas.

EDMONTON. — Value of Alberta crude-oil sales this year should pass the quarter-billion mark for the first time. Production for the first 6 months exceeded 50 million barrels with a value of $215 million. During all of 1954 Alberta oil output was 88,287,000 bbl., with a value of $227,877,000.

TORONTO. — Directors of Anglo- crude-oil sales this year should pass mended that stockholders of the company accept an offer by Canadian Oil Companies, Ltd., to acquire Anglo-Canadian's assets. The offer made by Canadian Oil is equivalent to $2.75 in cash and a one-seventh share of Canadian Oil for each share of Anglo-Canadian outstanding. Canadian Oil has a 20,000-bbl. refinery at Sarnia, Ont. Anglo-Canadian has 3,500 bbl. of production daily from interests in about 177 wells in various western Canadian fields.

SARNIA, Ont.—Canadian Oil Companies, Ltd., has started work on a $300,000 administration and plant protection building at its 25,000-bbl. daily refinery here. The building is part of a 3-year $3,000,000 expansion program.

Guatemala Has New Law, But . . .

. . . Oil Future Isn't Rosy

W. A. Bachman

GUATEMALA has finally enacted a new oil law. It now starts the uncertain struggle to acquire an oil industry.

Oil men last week generally expressed disappointment at provisions of the Central American nation's new petroleum law. They had hoped for more lenient financial terms to make exploration attractive. They felt government rentals, taxes, and 50 per cent profit-sharing were too heavy for risks involved.

The law is similar to statutes in Venezuela and Peru. It would be adequate for a country where oil production has been established. But oil men point out Guatemala is rank wildcat territory. It has no production. Drilling terrain is in jungle country, costs are high, marketing outlets difficult, and area available for exploration comparatively small.

The law will become effective in mid-August. The government of President Carlos Castillo Armas will issue regulations implementing the law within 60 days and an additional period of 30 days is provided during which original applications will be given priority.

Construction of refineries and pipeline systems also is envisioned in the new law, but observers say these would only come after any oil production is found. Domestic demand for oil products is too meager to sustain a large refinery operation now. Current demand is estimated at 4,800 bbl. daily with a demand of 6,400 bbl. expected in 1956. This of course could increase materially if roads are built and use of motor vehicles booms.

Concession terms . . . Applicants may obtain as much as a million acres in exploration rights and 500,000 acres for exploitation. Exploration concessions are limited to 6-year terms with two extensions of 2 years each. Exploitation term is 40 years with a possible extension of 20 more years.

Rentals for surface exploration range from 30 cents per hectare for the first 3 years to 60 cents after 6 years. Exploitation rentals range from $1.50 annually per hectare during the first 5 years to $6 after 10 years and $4.50 after 15 years.

Royalty will be 12½ per cent of the oil produced with companies allowed a 27½ per cent depletion allowance but subject to income taxes and a 50 per cent share of profits with the government.

Why the disappointment? . . . Oil men who sat in on conferences with government officials while the law was being drafted had hoped for a better shake. They still hope that Armas may amend the law to soften its provisions.

Its terrain and geology make Guatemala a big gamble for the oil man. Most interesting region for oil exploration is the Peten province, comprising about the northern one-third of the country.

Peten is bounded on the west and north by Mexico and on the east by British Honduras. It is inaccessible, rugged jungle country. Its past commercial activity has been limited to the mahogany lumberjack and the chicle hunter.

There are no present roads into the vast land capable of handling wheeled vehicles. Any drilling equipment would have to be hauled in by mule pack or flown in by airplane.

The present government has an ambitious primary road-building program planned, but it may be years before even crude roadways capable of handling oil-field equipment are cut into the Peten.

The 38,000-sq.-km. region is traversed by several rivers—none large enough, however, to accommodate any craft heavier than canoes. This is strange for a land which receives more than 150 in. of rainfall annually during a 5-month rainy season. The heavy downpours quickly filter through a topsoil composed of sedimentary weathered limestone and are carried off through underground channels. These channels also link a series of sink-hole type lakes which dot the flat northern area of the region.

One major oil company geologist termed the Peten "a hard place to do business." He estimated under present conditions it would cost a million dollars to drill a wildcat well in the region. That's a considerable outlay for a region whose potentialities never have been tested by an oil drill.

Is there oil? . . . What of the Peten's oil possibilities? Geologists are cautious on this point. There have been reports of oil seepages in the Peten for years, but some geologists dispute this. They claim they have found no evidence of any seeps anywhere in the country.

Peten is the sedimentary area of the country but certain conditions cast doubt on the oil value of the formations. Tertiary beds from which oil is produced in Mexico are present in Guatemala. But they outcrop in Guatemala and are not so thick. Cretaceous beds which also produce in Mexico are found in the Peten, but the lithology is quite unlike that in Mexico.

Several oil companies have spent large sums in preliminary work in Gua-

GUATEMALA'S NEW OIL LAW brought together government officials and oil company representatives at Guatemala City. Guatemala President Carlos Castillo Armas is shown in center. On his left is John Patrick d'Artois, manager in Guatemala for Conorada Petroleum Corp., and on the extreme right is Victor W. Carroll, local attorney for Conorada.

temala. Atlantic Refining Co. is reported to have spent $700,000 over a period of years. Shell also is believed to have laid out nearly $2 million in a complete geological study of the region. Both left without nailing down a drilling concession. Others who have studied the layout include Standard Oil Co. of Ohio and Ohio Oil Co. Most of these are conspicuously absent from the list of those jockeying for concessions under the new law.

Shell geologists in 1939 at the conclusion of their exhaustive study of the Peten area reported to their firm they "consider the oil possibilities offered by the deeper Cretaceous as extremely poor to very doubtful and those of the pre-Cretaceous as extremely remote, thus as not sufficiently attractive to warrant their exploration by the drill."

The same explorers reported they believed Permian beds may underlie the greater part of Peten and northern British Honduras but added there were no signs of oil or asphalt. They said they did not consider the Permian beds as a probable mother oil formation to feed Cretaceous reservoirs.

Some are interested . . . But oil is where you find it and crude is not always found under ideal geological conditions. Thus many still consider Guatemala's oil prospects reasonably attractive if exploration and exploitation rights can be obtained on good terms.

Companies interested enough in Guatemala to have representatives sit in at sessions on the new oil law included Union Oil Co. of California, Standard Oil Co. of California, Richmond Oil Co., Conorada Petroleum Corp. (Continental Oil Co., Ohio Oil Co., and Amerada Petroleum Corp.), Houston Oil Co. of Texas, the Clint Murchison interests of Texas, and Dillon-Reed & Co. of New York, representing 16 eastern investors.

Many of these said they believed the government would have to amend the law before it would attract risk capital in any large amounts.

One suggestion was a government moratorium on taxes for the first 5 years of a concession to allow a wildcatter to attempt to establish production. During that time the government would only take its royalty from any oil found.

This might prove sufficient incentive for an operator to brave the high costs of operating and difficult conditions to hunt for oil.

The Armas government is anxious to establish an oil industry in the country to boost the nation's economy. The nation long has had a stable currency and prior to the 1949 Communist-tinged regime tried to make the land attractive to foreign investors. This still is one of Armas' big objectives.

The government has undertaken a program of building a net of highways to open all corners of the republic, is building a port on the Atlantic tip of the country, and is planning electrical and communication facilities.

But whether the new oil law will nurture an oil industry for the struggling republic still is a question.

ROADS INTO THE JUNGLE are the big need if the Peten area of Guatemala is to be developed for oil possibilities. Three representatives of major oil companies are shown studying possible routes into the area. They are Lionel Wiedey, Standard Oil Co. of New Jersey; Frank Plaza, Standard Oil Co. of California; and J. P. d'Artois, manager in Guatemala for Conorada Petroleum Corp.

British Buy More Fuel Oil

The United Kingdom's central electricity board has signed a second major contract for heavy fuel oil for its power stations.

The board is making conversion to oil at 16 of its plants to ease pressure on the domestic coal industry in the nation's race for increased power production.

Latest contract for fuel oil supplies was made with Shell-Mex and B.P., Ltd., marketer in the United Kingdom for the Shell Group, Eagle Oil & Shipping Co., Ltd., and British Petroleum Co., Ltd.

Starting with small shipments, quantities gradually will increase to 60,000 bbl. daily by 1960. Contract runs for 12 years with provision made for extensions.

The contract is slightly larger than an earlier agreement reached with Esso Petroleum Co., Ltd., in June. This deal calls for shipments building up to about 50,000 bbl. daily by 1960.

World Output Tumbles

May free world figures down 2.1 per cent below average for April; U.S. shows largest drop, Canada greatest rise

Ray G. Gibson

CRUDE-OIL production in the free world snapped its string of six consecutive monthly records with a decline in May of 289,800 bbl. daily.

The dip resulted from cutbacks in the United States, Venezuela, Saudi Arabia, Iraq, and Iran.

The May production average of 13,403,000 bbl. daily in non-Communist countries was 2.1 per cent below the all-time record of 13,692,900 bbl. daily in April. But May output was still almost a million barrels above last November when the record-breaking spree began.

The November record was 12,539,000 bbl. daily. The mark was raised to 12,847,000 in December. World output crossed the 13 million mark for the first time in January with a daily average of 13,204,000 bbl. The pace slackened in April as output gained only 30,000 bbl. daily, foreshadowing the May decline.

U. S. production had the biggest decrease. Output of 6,677,000 bbl. daily was off 210,000 bbl. daily, or 3 per cent from April. The drop was the steepest since July 1954 when domestic output declined 4 per cent, or 258,200 bbl. daily, over the preceding month. Canada, on the other hand, had a bigger production increase in May than any other free world nation. Output rose to 321,000 bbl. daily, up 59,000 bbl. daily, or 22.5 per cent over April.

Crude output in Venezuela was off 104,900 bbl. daily, or 4.9 per cent, to 2,041,200 bbl. daily. On a 5-month average, however, Venezuela's production level was 2,118,700 bbl. daily, against 1,876,200 bbl. daily over the same period last year, an increase of 242,500 bbl. daily, or 12.9 per cent.

Middle East down . . . In the Middle East, production was down 37,200 bbl. daily, or 1.1 per cent, to 3,290,400 bbl. daily. The sharpest cutback was in Saudi Arabia, where output fell to 943,700 bbl. daily, off 35,300 bbl. daily, or 3.6 per cent. Iranian consortium companies produced an average of 285,000 bbl. daily in May, against 296,000 bbl. daily in April, off 11,000 bbl. daily or 3.7 per cent. In addition, 4,300 bbl. daily were produced in Naft-i-Shah field by the National Iranian Oil Co. This crude is refined and consumed locally.

Production in Iraq of 678,700 bbl. daily was down 20,800 bbl. daily, or 3 per cent from the record high level in April. Despite the decrease, output in Iraq in May was 4,500 bbl. daily higher than in March.

The only Middle East country with a production increase in May was Kuwait. Its output rose to a new all-time high average of 1,207,900 bbl. daily, up 28,600 bbl. daily, or 2.4 per cent over the preceding month. On a 5-month average, the shaikhdom's production was 1,114,800 bbl. daily, up 215,800 bbl. daily, or 24 per cent over the same period in 1954.

Others . . . In Europe, intensive development work in France, Germany, and in Sicily continued to show results. Production in France passed the 15,000-bbl. daily mark. In Germany, output averaged 60,000 bbl. daily for the first time in May. The development of Ragusa field in Sicily by American International Fuel & Petroleum Co., a Gulf Oil Corp. subsidiary, brought production in Italy to 3,700 bbl. daily in May, the fourth record in 5 months.

Production in Cuba rose to about 1,100 bbl. daily in May, in comparison with less than 600 bbl. daily in January. Jatibonico field was the main producer with an output of 800 bbl. daily. Inadequate transportation facilities and a poor market for 14°-15°-gravity crude have kept the field's output down.

TREND OVER THE LAST YEAR

	W. Hemisphere less U.S.	Middle East	Total non-Communist countries
1954—			
May	2,615.7	2,762.3	5,851.7
June	2,648.5	2,685.0	5,805.5
July	2,667.0	2,758.7	5,890.9
August	2,663.7	2,749.5	5,891.9
September	2,704.5	2,702.2	5,879.2
October	2,750.0	2,898.6	6,141.6
November	2,856.5	2,844.6	6,193.6
December	2,957.7	3,001.8	6,453.3
1955—			
January	3,001.5	2,950.1	6,442.5
February	3,050.4	3,109.3	6,653.8
March	3,036.0	3,247.9	6,775.8
April	2,981.6	3,327.6	6,805.9
May	2,938.0	3,290.4	6,726.1

CRUDE-OIL PRODUCTION
(Daily average in thousands of barrels)

Country—	May 1955	April 1955	May 1954
W. Hemisphere:			
Argentina	80.0	80.0	76.8
Bolivia	7.4	4.5	3.2
Brazil	4.6	5.4	2.1
Canada	321.0	262.0	197.8
Chile	6.5	6.3	4.5
Colombia	106.5	105.2	112.2
Cuba	1.1	0.9	0.1
Ecuador	9.1	9.1	8.7
Mexico	250.0	250.0	233.0
Peru	45.4	47.8	47.8
Trinidad	65.2	64.3	64.5
Venezuela	2,041.2	2,146.1	1,865.0
Total	2,938.0	2,981.6	2,615.7
W. Europe and Africa:			
Algeria	1.1	1.1	1.6
France	15.1	15.1	8.3
Fr. Morocco	2.3	2.3	2.5
W. Germany	60.0	59.5	50.4
Italy	3.7	3.2	1.5
Netherlands	19.4	19.5	18.4
Egypt	33.3	33.3	38.6
United Kingdom	1.2	1.2	1.2
Total	136.1	135.2	122.5
Middle East:			
Bahrain	30.0	30.0	30.1
Iran	289.3	299.8	36.7
Iraq	678.7	699.5	624.4
Kuwait	1,207.9	1,179.3	937.0
Neutral Zone	24.0	24.0	10.3
Qatar	114.2	113.4	96.4
Saudi Arabia	943.7	979.0	1,026.8
Turkey	2.6	2.6	0.6
Total	3,290.4	3,327.6	2,762.3
Other Asia:			
Brit. Borneo	99.0	99.0	99.5
Burma	3.7	3.7	3.5
India	7.0	7.0	7.0
Indonesia	230.0	230.0	217.5
Japan	6.0	5.9	5.6
New Guinea	10.1	10.1	12.7
Pakistan	5.8	5.8	5.4
Total	361.6	361.5	351.2
Total non-Communist foreign	6,726.1	6,805.9	5,851.7
United States	6,677.0	6,887.0	6,470.8
Total Free World	13,403.1	13,692.9	12,322.5
Communist-controlled countries:			
Russian occupied zone of Austria	57.5	57.5	62.0
Romania	125.0	125.0	110.0
Russia	1,235.0	1,235.0	1,135.0
Others	36.8	36.8	36.1
Total	1,454.3	1,454.3	1,342.1
World total	14,857.4	15,147.2	13,665.6

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Other Communist includes China and Yugoslavia as well as the Soviet satellite countries in Europe.

Exports Increased

Bolivia ships products to Brazil under 2-year pact

BOLIVIA will begin products shipments this month to Brazil, the newest customer for its small but growing production. The countries have a 2-year trade agreement.

Bolivia will ship 6,400 bbl. of gasoline monthly the rest of the year. From January to June 1956, shipments will gradually increase from 8,300 bbl. to 11,300 bbl. monthly. The following year they will amount to 12,600 bbl. a month.

Kerosine shipments will be 1,300 bbl. monthly until June 1956. At that time they will be increased in accordance with consumption in Brazil.

Deliveries will be made via the Brazil-Bolivia railroad. Prices, f.o.b. Santa Cruz de la Sierra, are 11 cents per gallon for gasoline and 10.7 cents per gallon for kerosine.

In return, Brazil will send manufactured goods to Bolivia.

Bolivia became an oil exporter last year when production from expanding Camiri field exceeded domestic demand. President Victor Paz Estenssoro has said that with the help of foreign capital, his country will be exporting $65,000,000 worth of petroleum products in 4 years.

Bolivia's biggest customer is Argentina. About 2,500 bbl. of crude daily is moved by the newly completed pipeline from Camiri field to the Argentine border.

Feldman Is Busy Abroad

D. D. Feldman Oil & Gas Co. is energetically pursuing its recently announced plan to look for oil in the Eastern Hemisphere.

The company, a medium-sized independent based in Dallas, opened an exploration office in Paris last month under Roger Henquet, owner and manager of Societe d'Etudes Petrolieres, Paris. *(The Oil and Gas Journal, July 11, page 102).*

Last week, it filed claims on an undisclosed amount of acreage on the west coast of Italy which Henquet says is on the same trend as Gulf Oil Co.'s discovery near Pescara.

Henquet also reported that Feldman is seeking acreage in Sicily, France, and Switzerland and hopes to acquire some more in the Middle East. He said the company is negotiating for two large concessions in France along with "some French interests" and expects action on its proposals in the near future.

Creole to Begin Huge Expansion at Amuay Refinery

Creole Petroleum Corp. has announced plans to expand its Amuay refinery in western Venezuela from 160,000 bbl. to 260,000 bbl. daily. The 100,000-bbl. expansion will enable Creole to enter the European and Eastern Hemisphere markets in a bigger way. Creole recently negotiated a contract with the Central Electricity Authority in England that will amount to about 50,000 bbl. of fuel oil daily. In 1950, Creole sold 22 per cent of its production in Europe and other parts of the Eastern Hemisphere. However, in 1954 only 15.8 per cent of the firm's production went to these markets. The expansion program will cost about $11,000,000 and will be finished by the end of 1956.

International Briefs

The Sicilian Regional Government has granted Royal Dutch-Shell permission to build a refinery at Palermo. It will have a capacity of about 20,000 bbl. daily. The plant will be connected with the main breakwater at the port of Palermo, where ships will be able to bunker without entering the port.

Cia. Espanola de Petroleos, S.A., (CEPSA) plans to install a bulk L.P.G. storage and distribution plant at its 40,000-bbl daily refinery at Santa Cruz de Tenerife, Canary Islands. The project is the latest in a refinery expansion program.

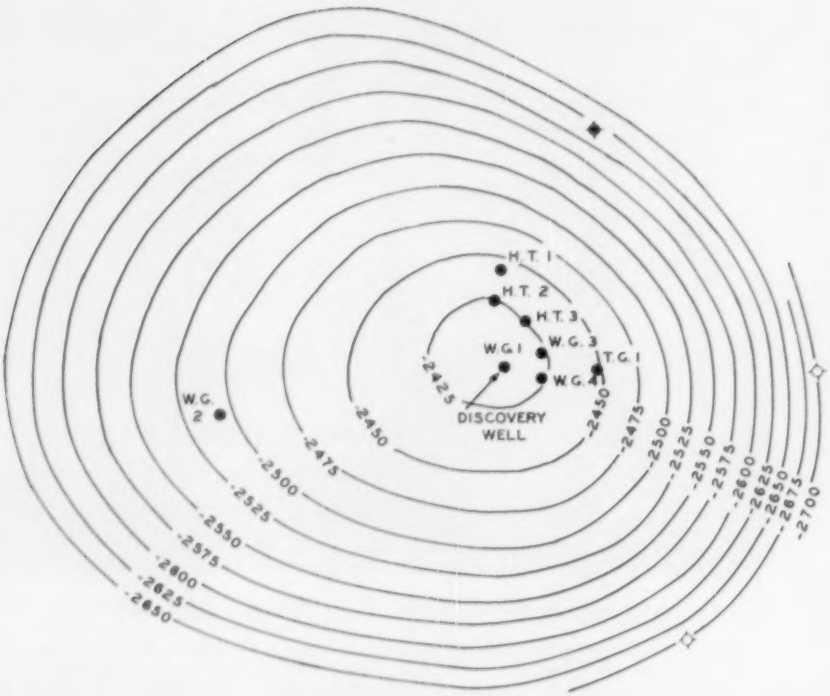
A 16-in. 188-mile natural-gas pipeline will be built from Pakistan's Sui fields to Moultan. Pakistan Constructors, a joint company organized by Morrison-Knudson, Boise, Idaho, and William Press, Ltd., London, will get the job. The same company built the 16-in. 350-mile line between Sui and Karachi. Work on the Moultan line will begin in mid-1956. Later the line will be extended to Lahore with branches to Kot Addu, Montgomery, Jhang, and Maghiana.

The Italian Government is still considering two proposals received from Russia and Romania. Romania suggested a joint Italian-Romanian company to build and operate a 20,000-bbl. refinery near Rome. Russia and Romania both have asked permission to set up bunkering stations in Italian ports.

Ente Nazionale Idrocarburi, Italy's state oil monopoly, has started negotiations with Petroleos Mexicanos with a view toward exchanging Mexican crude for Italian-manufactured refinery equipment.

Catalytic Construction Co., Philadelphia, has been awarded the contract to build a copper ammonium acetate purification system for Chemische Werke Huls in Marls, West Germany. The system will handle 40,000 short tons per year of butadiene in conjunction with a single-step Houdry dehydrogenation unit.

Two more 35,000-ton tankers will be built for the Esso Standard group by the Italian shipbuilding firm, Cantieri Navali Riunite del Adriatico. The first vessel of that class ordered from the firm is scheduled to be delivered in February 1957.



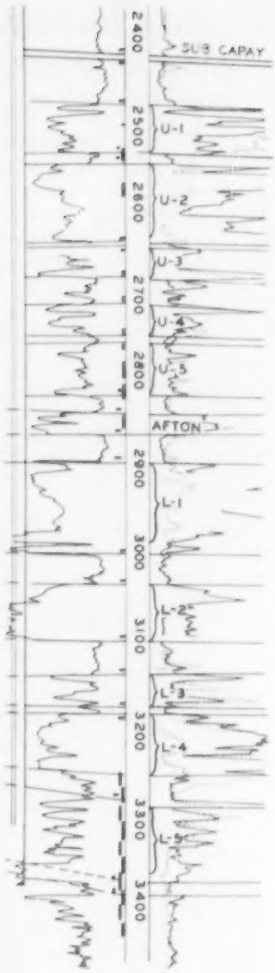


Fig. 1—(Above) Structural contour map of Wild Goose field as contoured on top of the U-1 zone, interval 25 ft. Discovery was drilled inside the highest closing contour.

Fig. 2—(Right) Electric log of Honolulu-Humble 1 Wild Goose. The pay intervals are typical of those found in other seven producers.

Wild Goose field is good example of

How to Get Maximum Recovery From a Dry-Gas Field

by D. H. Stormont
West Coast Editor

WILD GOOSE field in northern Sacramento Valley is an excellent example of how a gas field should be operated to obtain maximum ultimate recovery.

Conditions for such were favorable from the first. The Butte County discovery was a joint operation of Honolulu Oil Corp. and Humble Oil & Refining Co. In view of early lease consolidations, only two lessor groups needed to be considered when the field was later unitized, with Honolulu as operator.

The discovery well was completed at the very crest of the dome-like structure. Six of the seven others are near the crest, even though drilled before unitization took place.

A number of wells are dual completions. All are being produced so that the deepest pays—there are 11 separate sands—will be depleted first. This procedure will progress upward as lower members are abandoned. Just how this is being carried out is described later on.

A major gas discovery . . . Wild Goose field is not in the class of Rio Vista, California's largest gas field. But it is one of the largest gas reserves uncovered in Sacramento Valley since Rio Vista. Much smaller in size, it extends over some 1,200 acres. The exceptionally thick pay section compares favorably with that of Rio Vista.

Situated in a rice-producing area 10 miles west of Gridley, the field is appropriately named. It is on lands—submerged during duck season—of the Wild Goose Country Club, Tule Goose Country Club, and Hangtown Duck Club. For this reason development operations are restricted to a few summer months before duck season. Instead of conventional aluminum-painted surface facilities Wild Goose's are camouflaged olive drab, at the request of the gun clubs.

Honolulu-Humble 1 Wild Goose was completed on August 5, 1951. Its location was based on a reconnaissance seismic survey which showed a small dome-shaped structure. Initial flow was 4,000 M.c.f. of gas daily from Kione sands (Cretaceous age) at a depth of 3,192-3,260 and 3,292-3,314 ft. The well topped the structure at the highest closing contour as shown in Fig. 1.

Additional seismic work was then done as a guide to future development. Lease obligations prevented optimum positioning of the other seven wells completed; one later in 1951, two in 1952, and four in 1953. But as shown

Metering and pressure regulating station for Wild Goose wells. Output of each of the five zones being produced is regulated automatically by line pressure of the line serving the field.

in the structural contour map, six are near the peak of the structure.

No particular drilling problems were encountered in their completion, other than in obtaining water shutoffs. Because of the thick pay section and dual-completion programs, extensive cementing was necessary.

The eight producers and three dry holes on the eastern flank outlined a 950-ft.-thick series of sands extending over approximately 1,200 acres (see Fig. 2). Net sand thickness is around 640 ft. Gas-bearing portions of individual sands range from about 5 to 100 ft. thick. They total approximately 370 ft. in the crestal producer.

The sands in general are light to medium gray in color, quartzose, fine to medium grained, and vary from clean to silty. Porosities are in the range of 33 to 35 per cent. Average permeabilities for individual sands vary from 48 to 2,500 md. Average for all sand is about 1,800 md. The latter property makes for exceptionally high rates of production.

The 11 sand zones considered productive are continuous throughout the field. Some grade laterally, in whole or in part, to siltstone from well to well. But there is relatively little change in total thickness of individual sand members. In addition to these regular pays, some wells encountered nonproductive stray sands.

Reservoir pressures initially were in the range of 1,200 to 1,500 psi. After an initial drop of 20 to 40 psi., pressures of zones being produced have tended to level off, indicating an active water drive. Each of the main zones has its separate water table.

Operations as a unit . . . Unitization of the nine royalty interests was effected on September 1, 1953, on a volumetric basis.

In anticipation of unitization most development wells were located as close to the crest of the structure as permitted by ownership, fire hazard, and road consideration. With the accomplishment of unitization, need for drilling additional offset wells to protect royalty interests was eliminated.

These savings are secondary to added recoveries which will be gained through unit operation. Since it is not necessary to produce the wells so as to preserve landowners' equities, gas can be removed solely through upstructure wells. Rates of withdrawal from individual sands can be regulated to encourage orderly water encroachment and prevent bypassing, thereby assuring maximum possible recoveries.

Method of production . . . Four of the wells completed penetrate the entire gas section, although only five of the 11 pays currently are being produced. Lower zones in the four dual producers are produced through the tubing and upper ones through the annulus. The zones currently being produced are the L-5, L-4, L-1, U-2, and U-1. The remainder are behind pipe.

Minimum withdrawals, on an annual basis, are 12,000 M.c.f. daily, with a monthly low of 5,000 M.c.f. at midsummer. Maximum production during last January was 25,000 M.c.f. daily, with approximately 50,000 M.c.f. being produced for a few hours during peak demand periods.

As explained earlier, the field is being produced so that deeper zones will progressively be depleted until only the top pays exist. To accomplish this, withdrawal rates have been calculated for every well in every zone. This schedule will be adhered to, on an annual basis, as gas is withdrawn from progressively higher zones.

Under present operations withdrawals from zone L-5 are held constant at 1,000 M.c.f. daily. Any demand above this volume up to a total of 10,000 M.c.f. daily, is supplied by zone L-4. The next 8,000 M.c.f. would come from zone L-1. If demand goes still higher, zone U-2 will contribute 11,000 M.c.f. Any demand above this 30,000 M.c.f. total would be supplied by zone U-1.

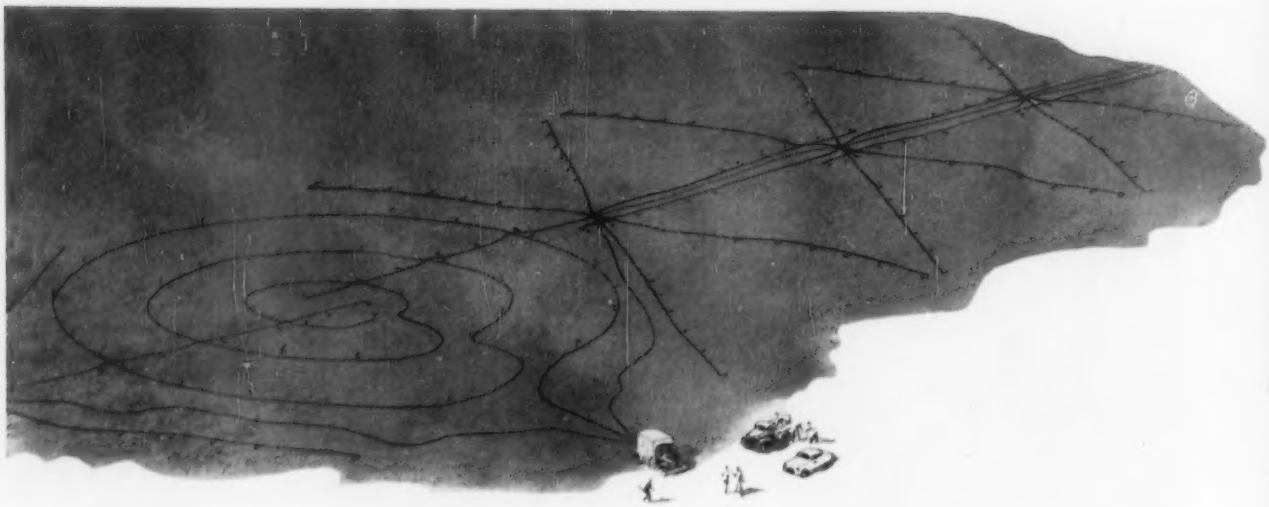
To accomplish these withdrawals, the wells are completed as shown in the following table:

Well	Zones
Wild Goose 1	L-5 & L-4
Wild Goose 2	L-4
Wild Goose 3	L-1
Wild Goose 4	U-2 & U-1
Hangtown 1	L-5 & L-4
Hangtown 2	L-1
Hangtown 3	U-2 & U-1
Tule Goose 1	L-4

The wells are equipped so that desired volumes automatically are produced in response to pipeline pressures. Diaphragm-operated pressure valves open or close the wells as line pressure dictates. Maximum rate of flow from individual wells is controlled by means of positive chokes.

Wild Goose gas is purchased by Pacific Gas & Electric Co. After passing through scrubbers and heaters the gas is metered, then transported through 6, 8, and 10-in. lines until entering the 16-in. carrier to Yuba City.

A characteristic of this gas is its high nitrogen content, about 20 per cent. Gas from individual sands vary from about 790 to 815 B.t.u.



STAR PATTERNS . . .

Improved seismograph technique produces good pictures where older methods failed.

Shown above is a simplified drawing of a typical six-point star-pattern layout which shows circular shot-hole pattern, left, and one leg of the main seismic cable with three pickup patterns in place. The other cable, with identical pattern arrangement, is out of picture at lower left.

Individual stars may be difficult to perceive, even in this simple sketch, because the patterns overlap. Note that two points of each star are laid parallel to the main cable and the other four points form a large X. The repeated X creates an illusory diamond design.

This arrangement of star positions simplifies the work of crew members who must walk the length of each star point to attach and remove the geophones. After each seismic shot, 432 geophones and connecting cables must be picked up and reassembled in a new position.

The sketch shows three cables leading to the instrument truck at the bottom. One is the shot cable which is laid out in three circles so as to connect all 36 shot holes for simultaneous explosion. The other two are the main seismic cables through which the impulses from the geophones are transmitted to the recording instrument in the truck. Each star makes one trace on the seismic record.

FIELD work has proved the worth of "star patterns" in laying out geophones in hard-to-shoot areas. This arrangement of geophones can effectively overcome troublesome seismic disturbances and produce a clear picture. It has opened the door to successful seismograph operations in many problem areas of the world which had previously proved unsuitable for seismic exploration.

The basic star pickup pattern, as developed by Humble Oil & Refining Co., actually resembles the spokes of a giant rimless wheel more than it does the usual concept of a star. The center point, or hub, is located on the main seismic cable, and the spokes radiating from this point are 210-ft. lengths of cable. Six geophones are spaced out along each of these spokes. In the lingo of seismograph exploration people, each spike is a "point," and the rimless wheel is a "star."

Typical setup . . . A typical star-pattern setup (see sketch) may have 12 stars stationed at 200-ft. intervals along the two main cables extending in opposite directions from the shot-hole area. The geophones are connected so that all the pickups in each star combine to make a single trace line on the seismograph record.

This is an abridged version of an article that originally appeared in The Humble Way, published by Humble Oil & Refining Co.

That the star-pattern method can give successful results where the conventional "in-line" method fails is attributable to two basic facts:

1. The use of numerous geophones in place of one gives a better pickup of the seismic echoes. It is an adaptation of the two-heads-are-better-than-one logic.

2. The horizontal star pattern in which the geophones are arranged has a focusing effect which gives a more selective pickup. Disturbance waves traveling near the surface tend to cancel each other out in the pattern of geophones, thus permitting the desirable reflections from below to dominate the message transmitted to the recording instrument.

Multiple shot holes . . . Originally the star patterns were used with a single shot-hole explosion, just as was customary with the conventional in-line seismograph method. Humble's men soon discovered, however, that better results could be obtained by using multiple shots of smaller charges in a pattern of shallow holes. This pattern is in the form of three progressively smaller circles, one within the other. Six shallow holes are drilled on the inner circle, 12 on the next larger circle, and 18 on the outer circle. When small explosions are set off simultaneously in all 36 holes, even waves of energy are directed downward by the pattern.

Field operating problems . . . Although the new star-pattern method of seismograph operations offered important advantages, it also posed some peculiar problems. For one thing, it created an immediate demand for large quantities of geophones. Working in close cooperation with the manufacturers, Humble's engineers helped in designing a practical, more compact type of geophone that could be mass produced at low cost.

In the field, seismograph-party members were confronted with the problem of handling the greatly increased footage of seismic cable needed for the star-pattern method. Humble crews soon abandoned the familiar drum reel in

MORE COMPACT and lighter geophone was designed because of the large numbers of geophones used for each setup.

AIR DRILLING has proved more economical than drilling with water. It is faster and eliminates hauling of water in arid country. Here a simple air-blower unit is mounted on bed of this shot-hole drilling truck.

SHOOTER loads the hole, using a converted golf caddy cart to carry the dynamite.

SEISMIC cable is stored in a bin instead of on the usual reel. It is piled in loosely.

favor of a simple open bin with a spinner wheel device—developed by an affiliate, Carter Oil Co.—to pull the cable into the bin. Oddly, the loose cable does not become tangled in the box and can be easily pulled out again for the next setup.

Many other standard operating procedures had to be altered for the star-pattern method, and more men had to be added to the seismograph parties. As the crews became more familiar with the new method they found ways to speed up the operations. Even so, it still takes about 40 per cent longer to shoot a given area with star patterns than with the former method. Generally, the improved results are well worth the additional expense.

Drilling With Air

But the biggest stumbling block to the use of star patterns in West Texas and New Mexico was the high cost of drilling the multiple shot holes. Drilling with water or mud is impractical in many parts of this semiarid region because of the scarcity of water. Often, attempts to drill with water hauled in by tank truck also have proved futile because the water was quickly lost in underground crevices.

These water problems were first overcome by adopting the compressed-air method of drilling in which the cuttings are blown from the hole by air pressure. But Humble's seismograph parties found this method also too expensive. In addition to the drilling-rig truck, it was necessary to have a truck for the big air compressor. The compressor alone cost about $9,800, to which had to be added the cost of the truck and the wages of the truck driver. And for every five compressors in the field, a maintenance man had to be hired to keep them in running condition.

Here again, Humble's scientists came up with a solution to the problem. They found, by study and experiment, that a large volume of air under low pressure is just as effective in removing the drill-bit cuttings from shallow holes as the high-pressure air provided by the compressor. By enlarging all orifice and channels through which the air had to pass to get to the bottom of the hole, the research men were able to substitute a simple blower fan for the giant compressor. The blower fan unit, which costs about $300, eliminates the need for the expensive compressor and the compressor truck. It also frees the truck driver and the maintenance man for other duties in the seismograph party.

All of these developments—the star patterns, the multiple shot-hole patterns, the air blower for drilling—are important contributions to the progress of oil exploration. Many companies are now using adaptations of the star-pattern method in various parts of the world.

Research and the ingenuity of American oil men have removed one more obstacle in the continuing search for new oil to meet the needs of the world.

BURST PIPE forms split in ductile-type failure. Fig. 21.

SPLIT at both ends is brittle-type failure. Fig 22.

SWELLING occurs before ductile break. Fig. 23.

BRITTLE failure caused this blowout. Fig. 24

2. Why Oil-Well Tubing and Casing Fail . . .

. . . Why They Burst, Leak, Crush, and Why Last Engaged Thread Fails

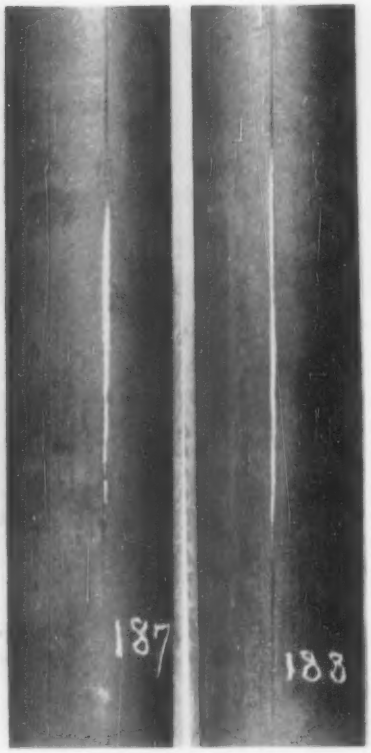
This second article in a series on casing and tubing troubles deals with failure by bursting, failure of the last engaged thread, leakage, and crushing. Part 1 covered tension and collapse failures; and Part 3, to follow, will cover wear, erosion, buckling, torsion, corrosion, and miscellaneous failure.

by H. G. Texter

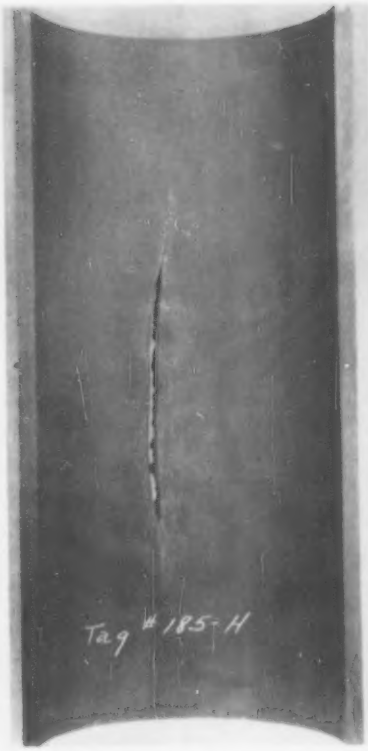
IN oil-well casing and tubing, a burst usually consists of a longitudinal split, 2 to 6 ft. long, with no tearing at the ends of the split, as in Fig. 21. Occasionally there is a "Y" at the ends of the split as though the material were starting to tear circumferentially, as in Fig. 22.

Fig. 21 is an example of ductile failure, and it is characteristic that the outside diameter of the pipe is swelled along the split. The pipe expanded in a ductile manner just before failing. This is illustrated in a side view, Fig. 23, of the failure shown in Fig. 21. In-

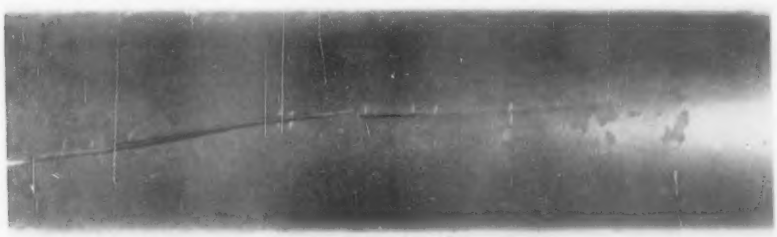
Author is chief field engineer, Spang-Chalfant Division, National Supply Co., Tulsa. Paper presented at A.P.I. Division of Production meeting, New Orleans, 1955, under the original title, "Oil-Well Casing and Tubing Troubles."



SHARP PLUG SCORES will lead to bursting even when shallow. Fig. 25.



MILL DEFECT called overfill reduced strength of this pipe over four times. Fig. 27.



BAD SEAMS will open under internal pressure. Only pressure tests can locate these weak places. Fig. 26.

cidentally, this actual burst failure was recovered from a high-pressure well near Haynesville, La.

If the casing has not been properly heat-treated or was accidentally quenched or cold-worked (as by sticking in the rolls), the split usually will be rather short. There will be no appreciable swelling of the unsplit portion. Furthermore, the pipe is broken transverely at one or both ends of the split (Fig. 22). This is an example of a **nonductile** or brittle type of burst failure.

Even less frequently there will be a section (or several sections) actually blown out of the pipe as in Fig. 24. This, again, is an example of a **brittle** type of failure.

Effect of plug scores . . . One mill defect that sometimes can lead to burst failures is the internal plug score (Fig. 25). A plug score, and there may be several or none in any one tube, is always longitudinal and usually runs the full length of the tube. It is the result of hard bits of metal which may stick to the high-mill plug during the rolling operation (right after piercing). In this operation the rough pierced tube is elongated by rolling between rolls and over a bullet-shaped mandrel or plug in a "high mill" or "rolling mill." It is during this operation that internal plug scores are formed.

Ordinarily plug scores are round bottomed and have little effect on bursting strength. It is only by accident that the bursting split will follow a score, even though it is more than 12½ per cent of the wall thickness in depth (and therefore beyond the A.P.I. allowable tolerance). Occasionally, however, a score is so sharp bottomed that it is, effectively, a sharp notch and will induce a burst failure. Unfortunately, the depth of the score is not a measure of its effect. So, blindly following the A.P.I. tolerances, it is often passed as being harmless, as was the case in Fig. 25.

Neither visual, mechanical, optical, nor magnaflux inspection can differentiate between a harmless score and a serious one. So far as we know, only a high internal-pressure test (to, say, 80 per cent of the calculated minimum yield strength) will cull out harmful plug scores. This is particularly true for tubing.

Effect of seams . . . As a cause of burst failures, external (and sometimes internal) seams are similar to plug scores in their effect. Seams (which may seem an anomalous term when applied to seamless tubes) are longitudinal discontinuities with a left-hand spiral. They exist quite universally in casing, tubing, and other tubular products made by the modern domestic piercing process.

Some seams are so minute they can be found only by polishing and magnafluxing the surfaces of tubes. However, quite a few can be seen by careful examination of the unpolished surface. Some seams are so utterly harmless that when bursting is induced the rupture will not follow the seams at all. This is true even of seams which have depths as great as 15 per cent of the wall thickness. It is partly for this reason that 12½ per cent depth is permitted by the A.P.I. specifications. Some seams have the appearance of being what are called hairline or tight seams, and in order to be sure of their depth it is necessary to explore the depth by grinding and checking the depth with a dial indicator.

Really bad seams will, of course, tear open under internal pressure, as in Fig. 26. However, a seam such as this one cannot be detected easily. In fact, experience has shown that bad-looking seams often fail elsewhere in the tube while harmless-looking ones may tear open under test, as in the case shown.

So, the only logical and sensible procedure is to high-pressure test all tubes regardless of the surface appearance.[12] Therefore, the A.P.I. has now set up new mandatory and alternative hydrostatic-pressure test tables.

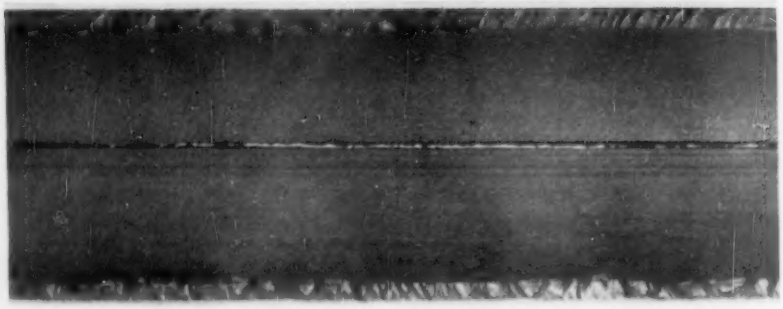
Other mill defects . . . Another, but unfortunately rare, type of mill defect which can result in burst failure is known as a high mill "overfill" or "fin." This, also is formed in the rolling operation. It is caused by the outside diameter of the pierced billet being too large for the groove in the high mill rolls.

This defect is difficult to detect by mill or field inspection methods short of magnafluxing or magnagloing or, better still, by high-pressure testing. An overfill is a longitudinal section of the pierced tube which was squeezed out between the two rolls of the high mill during the tube's first pass through the mill and is then rolled down and pressed into the outside surface in the second pass.

An example of such a defect which failed by bursting in a well is shown in Fig. 27. It failed at a known maximum well pressure of 1,500 psi., disregarding any pressure surges, and undoubtedly would have failed in a high-pressure test. This would have been 6,600 psi. for the size, weight, and grade involved (new A.P.I. mandatory test for 7-in., 26-lb. N-80).

Other mill defects, previously mentioned under tension failures, which might conceivably result in burst failures, are quenched areas and work-hardened areas.

Welded casing, but seldom seamless, can unintentionally contain laminated areas which have resulted in burst failures. This comes from skelp (the sheets or stirips from which welded casing is formed) made from blooms which were cropped too close to the upper end of an ingot. While cooling, the molten metal in the top of an ingot mold shrinks down, leaving an open or porous depression. Rolling the ingot into blooms cannot weld this cavity. If not cropped and discarded, it results in bars or sheets having slag and dirt inclusions between two layers of clean metal. This is known as "laminated" steel. There is no simple method of detecting it, and a poor, although normal-looking product may be shipped to the consumer.



THIS TUBING BURST because of sharp-bottomed plug scores. Fig. 30.

Here, again, high-pressure testing can eliminate the defective lengths. The lamination may be too slight to fail under an 80 per cent hydrostatic test and will not be revealed during a threading operation. If so, it can be considered capable of meeting all other performance values.

Design Factors—Bursting

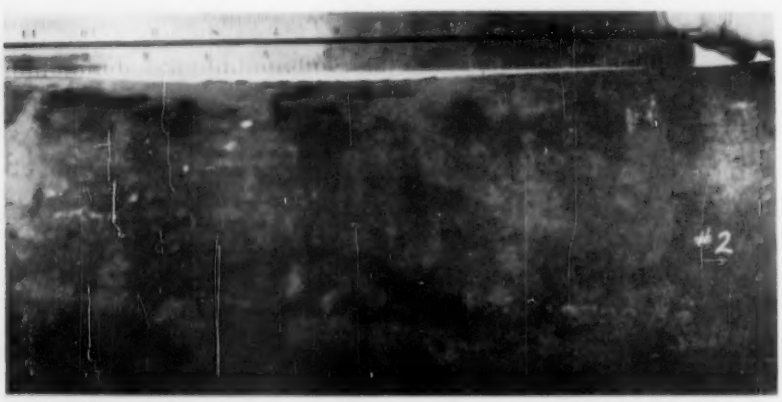
As with tension and collapse, a proper design factor in selecting the weight and grade of casing is of first importance. Tubing may be run inside, packed off at the bottom, and the annulus filled with mud. Still, it should be assumed that the full shut-in pressure of the well might be imposed on the inside of the casing string. The packer might fail, the tubing may leak, or even burst. The casing would then have to withstand the full pressure.

A commonly used design factor against burst, for casing, is 1.0. This may seem rather low. It is based on the assumption that the well is producing pure gas, methane for example, and bottom-hole pressure, in pounds per square inch, is equal one-half the depth in feet. It also assumes that gas has no weight and top-hole pressure is equal to bottom-hole pressure. This, of course, is not true. The difference between the assumed top-hole pressure and the actual figure is an additional safety factor.

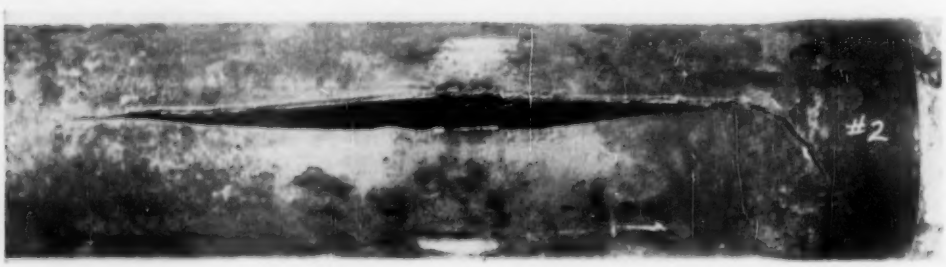
Thus, a 10,000-ft. gas well with bottom-hole pressure of 5,000 psi., might tave top-hole pressure 70 per cent of this, or only 3,500 psi. (considering the weight of the gas). So, if the top length of casing were selected to have a 1.0 design factor against bottom pressure, neglecting the gas weight, the actual design factor, against 3,500 psi., would be 1.0/0.7 or 1.43. That is quite reasonable.

Barlow's formula for calculating burst strength of a tube is incorrect except for very thin-wall tubes, but the error is on the side of safety.[4] In addition, the published A.P.I. Bulletin 5C2 figures are only 87½ per cent of the calculated internal yield-pressure figures, based on published wall thicknesses. This gives a further safety factor. Hence, the justification for so low a design factor as 1.0.

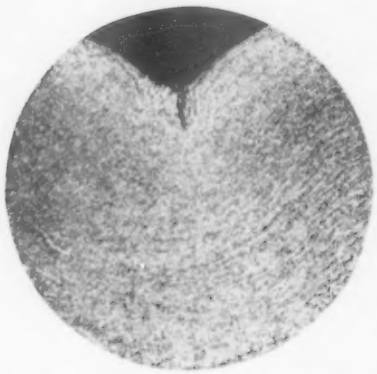
Usually only the bursting strength of the top length in a string need be con-



TONG MARKING which deforms and notches the pipe as shown here seriously reduces the bursting strength. Fig. 28.



BURSTING of the tong-dinged pipe occurred at 60 per cent of the original strength. Fig. 29.



PLUG SCORE micrograph shows sharp bottom which causes failure. Fig. 31.

sidered. Effectively, there is no fluid surrounding the top length; but as we go down, there may be more and more external fluid pressure. Thus, the differential internal pressure rapidly becomes less and less.

If there is a change in section either as to grade or weight near the top, then the differential pressure inside the top length of the new section should be taken into consideration. This is very seldom critical in an average casing string; but if there is no fluid surrounding the casing, this fact must then be taken into account in figuring the design factor.

Pressure testing . . . After designing a casing string against burst, the next most important step is to hydrostatically internal-pressure test each length of casing. This should be done either at the pipe mill or on the location, to 80 per cent of the calculated minimum internal-yield pressure (see new A.P.I. mandatory and alternative hydrostatic-test pressures for casing and tubing[7]) before running the casing in the well. This is good practice not only for the production string but also for the outer strings. It is the simplest performance-value test of casing ever devised.

In addition, for high-pressure wells many companies are testing the cemented production string before drilling out the cement plug. The pressure is more than the expected shut-in top-hole pressure. This can very easily be done with modern cementing pumps at nominal cost. It is much better to have a failure at this stage than after the well has been brought in.

For example, an operator in Wyoming tests the production string, usually 7-in. o.d., in 13,000-ft. high-pressure gas wells, to 6,000 psi. mud pressure. It holds this pressure for 30 minutes. Thus he knows the string was landed in good condition and any later failures must be caused by drilling, gun perforating, or other completion operations. Furthermore, this is a good test of the joint tightness and as to whether the lengths were screwed up properly.

Effect of tong marks . . . Tongs can dinge casing and reduce collapse strength. This damage is even more critical with bursting because of the longitudinal notching effect of the tong dies in combination with the dingeing. One writer[14] states, "The critical combination of notching at the axis of the flattened area reduced bursting pressures as much as 70 per cent with notch depths of 15 to 17 per cent of the wall thickness and ovality of 3 to 4 per cent."

In 1945 a mill bursting test was conducted on several tong-dinged lengths of 5½-in., 17-lb., N-80 casing that had been pulled from a well. Fig. 28 illustrates the degree of dingeing and Fig. 29 shows that the bursting fracture originated in the tong marks. This particular sample failed at 8,640 psi., whereas the true burst pressure, calculated on the actual (from strip tests) ultimate strength of the metal, should be 14,370 psi. Thus, the combination of dingeing and die notching made a 40 per cent reduction in the bursting strength.

Biaxial stress effect . . . The effect of tension is to decrease the resistance of collapse. Fortunately, the reverse is true for bursting. The Nadai-Holmquist paper[9] shows that, up to the yield point in tension, the effect of tension is to increase the resistance of casing to burst. Ordinarily, this factor is not taken into account in calculating safety factors against bursting. Therefore, there is an added uncalculated increase in safety factor.

Bursting—Tubing

Most comments on bursting of casing, apply equally well to tubing.

Bursting is a relatively common form of tubing trouble, especially in high-pressure wells, and can be exceedingly serious. For example, a string of 2⅜-in. tubing failed by splitting near the top of a 13,500-ft. well in South Texas. The well had to flow practically wide open for some 8 months before the owners dared try to shut in and kill the well. Had they shut in earlier, more than 9,700-psi. pressure would have been imposed on the surrounding 5½-in.-o.d., 20-lb., N-80 string. The casing probably would have burst also and pressured all the horizons in the area. Had this happened, a field potentially worth $175,000,000 might have been ruined.

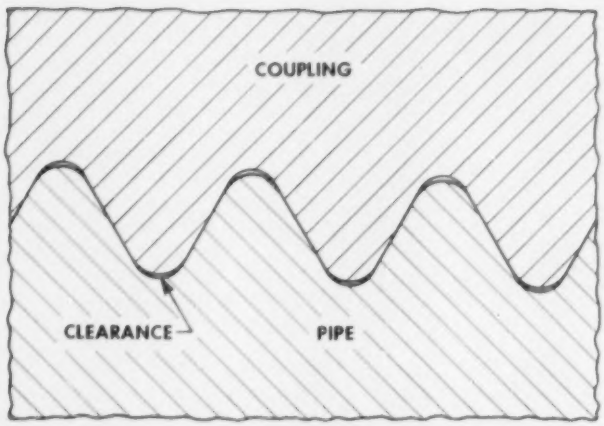
A relatively new cause of bursting tubing is its use in hydraulic formation-fracturing operations. The pressures involved are sometimes quite high.

Plug scores . . . As in casing, plug scores on tubing may be a focal point for failure. In Louisiana in 1947, four lengths of tubing failed successively in a string of 2⅜-in. which was being tested up to 4,800 psi. before being opened up for production. All of these failures were in sharp-bottomed, but not very deep, plug scores (see Fig. 30). Upon cutting open for examination, the scores were found to be within the A.P.I. allowable depth specification, but

DEEP TONG MARKS caused this tubing failure. Fig. 32.

THREAD FAILURE of this casing resulted from vibrations caused by crooked kelly. Fig. 33.

SHARP-THREADED tubing will frequently fail at last engaged threads as shown here. Fig. 34.



LEAKAGE of pipe threads can occur through small spaces left by incomplete mating of crest and root. Fig. 35.

were very sharp bottomed (see photomicrograph, Fig. 31). They could not have been culled out by any mill or field inspection method short of high-pressure testing.

Tong marks . . . Tong crushing or notching is just as fatal for tubing as for casing. Fig. 32 is a view of some 2⅞-in.-o.d. tubing which failed in a fairly deep well at Neiber Dome, Wyoming, in 1947. Evidently, deep tong marks were directly responsible, as the shut-in pressure was reported as being only 1,500 psi.

Preventing tubing . . . Precautions against burst failure of casing also apply for tubing. Above all, before running tubing into high-pressure wells, the lengths should be tested to the new A.P.I. high-pressure figures and rattled with air hammers while under test. Also, if practical, the strings should be high-pressure tested in the well, as recommended for casing.

Last-Engaged-Thread Failures

For casing, last-engaged-thread failures are pretty much a thing of the past, but the principles should be set down.

Casing sometimes fails by fracturing at the root of the last engaged thread. A much more common cause of this type of failure is not tension, but fatigue; and in these cases, tension is often a minor or negligible factor even though the result looks like a tension failure. Lack of knowledge of the causes of last-engaged-thread failures leads to an incorrect approach to their elimination.

Mechanism of failure . . . It seems to be almost purely a notch phenomenon in which the root of a thread is the notch and the fatiguing action is that of bending. The angle of bend is actually minute, but it is bending nevertheless.

In nicking and breaking a rod in a vise, the bending action is of high amplitude but involves very few stress reversals. In casing failures, the bending action is conceived to be of extremely low amplitude but of a very high number of stress reversals. In other words, the bending effect is that of a vibration of a frequency approaching that of sound waves.

The cause of the vibration is the pounding of the unprotected drill string (drill pipe, drill collars, or kelly) which is rotated inside the casing string while drilling ahead. Not much drilling is done inside a production string, but a great deal is done inside the outer strings; hence the reason for the much greater frequency of last-engaged-thread failures in secondary strings compared with the final string.

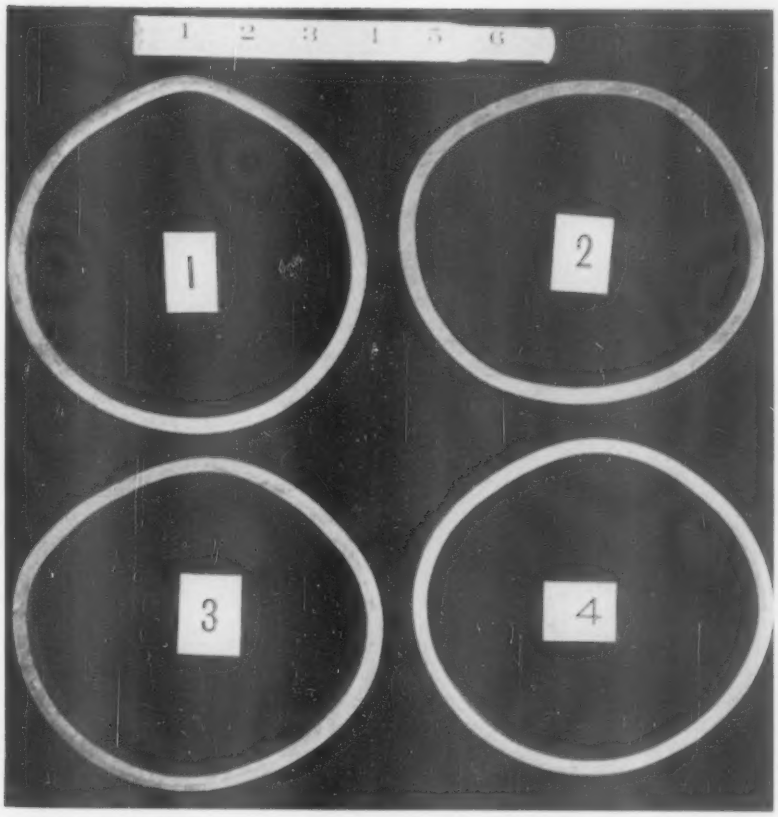
The obvious step for prevention of the trouble is to dampen the blows of the drill pipe against the inside of the casing. This is readily accomplished by the use of heavy rubber protectors on the drill pipe, kept close to the tool joints. The latter are the principal offenders in casing vibration.

Fig. 33 is representative example of a last-engaged-thread failure in a length of 8⅝-in.-o.d., 28-lb., H-40 casing from an Andrews County, Texas, well in 1947. The failure occurred 62 ft. below the surface in a 4,000-ft. secondary string, after 24 days of drilling. A crooked kelly with no rubber protector was being used, and its pounding was undoubtedly the source of the vibration resulting in the failure.

Measured up from the point of the pipe thread, the point of failure is the last root of a thread engaged with a coupling thread which is the notch at which the minute bending stress was concentrated. Hence the term "last-engaged-thread failure."

Factors involved . . . In the early days of drilling Big Lake field in Texas and Oklahoma City and Crescent pools in Oklahoma, the author spent considerable time studying last-engaged-thread failures and came to the following well-demonstrated conclusions which should be applied almost anywhere:

1. That the great majority of them occurred in 10¾-in. and 8⅝-in. secondary strings, set at 3,500 to 6,000 ft.
2. That all failures occurred above the cement or freeze point.
3. That the straighter the holes, the more the failures. Crooked holes tend to damp the vibration.
4. That in practically every case rub-



CARELESS TONGING of this casing deformed it badly. Out-of-round casing has low strength against collapse. Fig. 36.

ber protectors were not being used on the drill pipe, were bady worn, or were not kept close enough to the tool joints.

5. That tension was either a very minor factor or not a factor at all. In one case in Texas, 15 last-engaged-thread failures were fished out from one string of 9⅝-in. After the first failure, some of the pipe must necessarily have bent in compression, not in tension.

6. That the old A.P.I. sharp-V thread was more subject to fatigue than the present round-V thread.

7. That the grade of steel is not a factor. All grades and all makes of pipe, seamless and welded, were involved.

Inasmuch as, in the last decade, very few cases of last-engaged-thread failures in casing have come to the author's attention, it can confidently be assumed that the difficulty has been solved—principally by insuring that ample rubber protectors are on the drill pipe which is used inside the outer string and, secondarily, by the almost universal adoption of round-V threads.

Last-Engaged-Thread Failures—Tubing

As with casing, this is no longer as prevalent as it was some years ago. Nevertheless, it does still exist and the same reasoning applies as to the cause. However, with tubing the vibrations are caused by pumping operations instead of by drill pipe. Also, it occurs most often in nonupset tubing. The heavy wall under the threads of upset tubing usually prevents this type of fatigue failure.

As with casing, it occurred more frequently in the days of the old sharp-V threads than today. Present round-top, round-bottom threads naturally present less opportunity for stress concentration, which is the forerunner of a fatigue crack.

A good example of a typical last-engaged-thread failure is in Fig. 34. This is old 10-V (sharp) thread tubing which had been in service for 7 months in a 2,200-ft. South Louisiana pumping well in 1940.

Prevention of this trouble is obvious: Avoid sharp-V threads and use only upset tubing in all except very shallow slow-pumping wells.

Leakage and Crushing

Ordinarily one thinks of fluid leakage as a result of internal pressure; i.e., the fluid is leaking from the inside of a pipe to the outside. However, leakage in either direction must be considered since tubular strings must resist both inside and outside pressures. The same factors apply in either direction.

Thread Shape

Fig. 35 shows the detailed shape of A.P.I. casing (or tubing) threads. As indicated, the mating threads of pipe and coupling are designed to meet flank to flank without appreciable clearance; but there is a definite, although small, clearance purposely left between the top of each thread and its mating root.

The reason for this clearance is the inability of pipe-threading machines to produce threads so accurately, time after time, that each crest would fill completely each mating root as reliably as each flank can be cut to fit its mating flank. The chasers which are used to cut the threads could be made to do this a few times, but the tops of the thread chasers of the die head wear much more rapidly than the roots (or the flanks), so that the resultant roots in the pipe threads would soon have a larger radius than the resultant crests.

Then, when making up such threads there would be heavy bearing between mating crests and roots with the result that the flanks would no longer meet. So the lesser of two evils is chosen and positive clearance between crests and roots is provided. This clearance gradually becomes less and less as the chasers wear, but there is no guarantee that the fit ever will be perfect as to all elements.

Mechanism of Leakage

It must be evident, then, that if perfectly dry pipe and coupling threads could be so tightly screwed together (without galling) that the flanks came into proper contact, there still would be a small helical aperture between the crests and roots through which fluid could and would flow. Even a light lubricant can seal off this helical passageway, but only against a relatively low differential pressure. The pressure to cause a leak would be only that required to overcome the capillary attraction inertia of the fluid already in the helical passageway.

There can be a "hill-and-dale" form of leakage in which the fluid moves axially instead of helically. In this case the path of leakage, as indicated by the name, is up and down as well as forward. However, to permit this, the flank contact would have to be extremely poor.

In helical leakage, a lubricant of higher viscosity withstands a greater pressure. Solid filler is mixed with the lubricant to make pipe-thread compounds. Common fillers are red lead, graphite, and powdered metals such as zinc, lead, or copper. These are usually mixed with calcium or aliminum soap-

UNEVEN TONG MARKS show a bad tong head which caused crushing of pipe. Fig 37.

SLIP-CRUSHED CASING may result from too-short slips, left, or nonuniform gripping, right. Carelessness is the cause of this happening. Figs. 38 and 39.

base greases.[16] Even such mixtures as white lead and linseed oil make excellent sealing agents; but they are not true lubricants because they harden with age and will not break out satisfactorily.

Properly cut pipe and coupling threads, within the A.P.I. specifications using existing lubricants, can be screwed together so as to make joints that will be tight against water, oil, or gas up to the yield strength of the pipe body for either internal or external pressure. At least this can be done in a mill or shop; but to do it in the field under often adverse working conditions and weather is an entirely different proposition, hence the great amount of leaking trouble reported when casing or tubing is field tested for leakage, or strings are tested in wells.

Preventive Steps

In A.P.I. RP 5C1: Recommended Practice for Care and Use of Casing, Drill Pipe, and Tubing, instructions and suggestions are given for properly cleaning, lubricating, and running pipe into wells for maximum assurance against leakage. The various factors and their effects are:

. . . a. Cleaning. If not properly cleaned the joints will not make up far enough and leakage can result. Also sand and grit can cause galling, with likelihood of leakage.

. . . b. Lubricant.[16] Should contain one or more of the fillers, such as zinc, powdered copper, graphite, etc., mentioned previously. Too thin a lubricant may seal temporarily but be forced out in time under pressure. Too heavy a grease will not spread properly, especially in cold weather, leaving unprotected metal with resultant galling.

. . . c. Stabbing. Careless stabbing can damage starting threads and cause galling.

. . . d. Spinning. Rope spinning, before tonging, can be done at too high speed and result in galling, especially beause of side pull involved.

. . . e. Tonging. Insufficient tonging can result in leakage. Overtonging may cause galling, with possible leakage.

. . . f. Tension. There is a common misconception that high tension is conducive to leakage of A.P.I. threads. This is based on the theory (discussed under Tension) that the threads slip apart as a result of the radial component of the longitudinal force, and provide an opening for escape of fluid.

However, it is now known that there is no more tendency for a threaded connection to leak at high tension loads than at zero load.[17] So, this being true for either casing or tubing, there is no merit in letting off tension after strings have been landed, so far as this score is concerned. Other factors should

COCKED TUBING SPIDER punched the hole in this tubing. Fig. 40.

be the criteria governing landing practices.

Partly because of the practical difficulties encountered with the present A.P.I. threads, even with the best lubricants, several patented casing and tubing joints[6-18] have been developed in which there is some sort of positive metal-to-metal or gasket seal. These do not depend on a lubricant except to prevent galling, and have been used successfully for many years. An objection to their use is their greater cost and the fact that, being patented, they have never become an A.P.I. standard and are therefore not interchangeable, one mill with another.

Prevention of leakage . . . The necessary steps to prevent leakage should be obvious. Of most importance are: cleaning the threads, use of a proper lubricant, and careful makeup. In other words, follow meticulously the recommendations in A.P.I. RP 5C1, Sec. I.

Because of time or handling factor, still another step is becoming almost mandatory where high pressures are involved.

Experience has shown that threaded products will often show leakage (between pipe and coupling) during field testing even though no leakage was evident during mill testing. Time is the factor involved, plus handling. The lubricant seems to dry out and the vibration due to railroad and other hauling aggravates the condition. Shipping to South America, for example, will show up to 30, 40, and even 50 per cent leakers when high-pressure tested on location. The leakers are all at the mill connection.

The leakage can be and is stopped by simply unscrewing the couplings, regreasing both threads, and reapplying. This is now regarded as a very efficacious method of leakage prevention and is followed by a number of large companies, especially for tubing strings in high-pressure wells. It suggests, of course, the advisability of shipping tubing with the couplings boxed separately, or applied only handling tight, so that both male and female threads will be freshly greased before being run into the well and permit the coupling to "float" into position while being made up.

This practice could just as well be applied to casing, but is not being done to the best of the writer's knowledge. One reason is that casing for very high-pressure wells often is a positive sealing type of integral design, not involving a coupling.

Testing against leakage . . . Casing strings may be, and are, pressure tested in place before drilling out the cement plug. This is not only a check against bursting but is, of course, also a check against leakage through the threaded connections. The same practice is sometimes followed for tubing and is to be highly recommended, especially where high pressures are involved.

Also, for tubing there are at least two testing services in the field which can test very efficiently the single, or several, madeup joints as the string is being lowered into the well. Thus, predetermined pressures can be imposed on every connection, as made, and may be held for as long as desired (usually around 5 seconds). The writer very highly recommends this practice for running tubing in any high-pressure well.

This service could be adapted to casing but, so far as the writer knows, has not become common practice.

Crushing by Slips and Tongs

The obvious preventive measure for crushing by slips and tongs is to use slips of sufficient length and tongs of proper design for the load involved.

Figs. 36 and 37 show very flagrant carelessness in tonging some lengths of 5½-in. o.d. 14-lb. H-40 casing (in Magnolia field, Arkansas, in 1943). The ring sections show how badly the tubes were deformed and the tong marks indicate how nonuniformly the tong dies had gripped the pipe. Investigation indicated that the tong head was both worn and out-of-round. The remedy for trouble such as this is obvious.

Fig. 38 illustrates a slip-crushed 5½-in., 20-lb., N-80 casing length from the top of a 9,200-ft. Northwest Colorado well. Very evidently the casing-head slips were too short for the load.

Fig. 39 is another example of slip-crushed casing, involving 8,350 ft. of 7-in. o.d., 26-lb. N-80 in a Ventura, California, well. The welding at the top is where a short length of casing had been welded onto the crushed one for lifting the pipe out of the slips.

Fig. 38 shows the slips were too short. In this second example the slips may have been long enough, but they were not positioned properly and failed to grip uniformly around the outside of the pipe.

There is no excuse for slip crushing in casing heads. Modern heads are so well designed that any loads, up to the maximum tensile strength of the body of the pipe, can be withstood permanently without appreciable deformation of the casing. Thus casing strings may be landed and hooked up in full tension without fear on this score.

Fig. 40 is a piece of 2⅞-in. o.d., 6.50-lb. N-80 tubing. A hole has been punched in it by a cocked tubing spider—an example of carelessness.

Note: All references were listed with the first installment of this article, issue of July 4, 1955, page 86.

BOOKS

A.S.T.M. STANDARDS ON ELECTRICAL INSULATING MATERIALS, 1955 ISSUE. Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3. 660 pp., $5.50.

This issue covers the latest A.S.T.M. methods of testing and specifications for electrical insulating materials. It includes 60 test methods, 17 specifications, 3 recommended practices, and 1 list of definitions. Fully 33 of the designations are either new or have been revised since the last issue was published in March 1953.

Four appendices discuss: (1) the significance of tests of electrical insulating materials; (2) recommendations for writing statements as to the usefulness of tests of electrical insulating materials; (3) a proposed test method for the dielectric constant and dissipation factor of aviation fuels; and (4) a proposed test method for pasted mica used in electrical insulation.

CALCULATION OF STATIC BOTTOM-HOLE PRESSURES OF NATURAL GAS WELLS FROM SURFACE MEASUREMENTS. By Paul B. Crawford, R. I. Bradford, A. C. England, and Henry Ince. Published by the Texas Petroleum Research Committee, University of Texas, Austin 12. 20 pp., $2.50.

Designated Bulletin No. 40, this booklet presents a method and manual of procedure developed by T.P.R.C. to facilitate determination of the performance and potential of gas wells. The method is said to increase the accuracy of calculations of static bottom-hole pressure from surface observations, and to permit all computations to be readily checked. Graphically explained by 13 working charts with examples, this T.P.R.C. method has been authorized by the Texas Railroad Commission for use in the adjustment of absolute open flow for the determination of the potential of gas wells.

GEOLOGY AND ENGINEERING. By John R. Schultz and Arthur B. Cleaves. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 592 pp., $8.75.

This book integrates geology and engineering to give the practicing engineer a better grasp of how the two work together to solve mutual problems. At the same time, it offers the geologist a review of the engineering methods that he can profitably use in his work. Much emphasis is placed on soils and the application of geology to soil mechanics. Both of the authors are geologists with much experience in the application of geology to engineering work. They have carefully balanced the subject material between the two sciences, illustrated each subject fully, and included the latest data available.

TWO-WAY RADIO IN PETROLEUM DRILLING AND PRODUCING OPERATIONS. Published by the central committee on radio facilities, American Petroleum Institute. Limited number of copies available on request to Dow, Lohnes & Albertson, Munsey Building, Washington 4, D. C.

The use of two-way radio communication for drilling and production is briefly covered in this A.P.I. manual. It traces the history of two-way radio's use, explains the need for such rapid communication in both onshore and offshore producing facilities, and cites examples of the help that two-way radio has been in specific emergency operations. Designed as an introduction to its topic, it is simply written and will give nontechnical people a quick review of this growing communication media in the oil industry.

Water Injection Curbs Engine Detonation

Tests by Southern Counties Gas show definitely that controlled application of moisture into scavenging air stream of two-cycle engine will suppress detonation, improve engine performance

by F. R. Cramer

RECENT tests on a 1,650-hp. pipeline compressor engine shows that water, in the form of fine droplets, can be injected into the scavenging air system to prevent detonation. The injection is preferably made after the scavenging air has been compressed. A bonus to the method is that over-all engine efficiency is raised. These tests were made on an engine at the Blythe compressor station of the Southern Counties Gas Co. of California. The following report gives the background leading up to the tests and results of the experiments evaporatic cooling of scavenging air and water injection.

About 2 years ago we became interested in cooling the scavenging air streams of large, two-cycle gas engines. We had experienced detonation during periods of maximum load, when ambient temperatures were in excess of normal acceptance test conditions. A high-capacity evaporative cooler proved remarkably efficient in cooling the air stream. And it completely eliminated detonation problems on the engine to which it was attached.

Author is engineer with Southern Counties Gas Co. of California. Paper presented at the Gas Supply and Transmission Conference, Pacific Coast Gas Association, May 2-3.

This installation operates exclusively on water for its filtering and cooling action. See Fig. 1. At the time of the tests we had a frustrating corrosion problem. The unit relied on the intimate union of air and water for performance. That same feature produced the ultimate in corrosivity.

Ideally then, we needed a machine which we could use for evaporative cooling only when it was essential to detonation prevention, and which would still be an adequate filter during the spring, fall, and winter months.

Dual-purpose filter . . . At about this time one of the major filter manufacturers announced a combination oil filter-evaporative cooler unit, shown in Fig. 2. This machine was a dual-purpose filter operable on either an oil or oil-water cycle.

Their conventional "cyclonic" oil filter had been fitted with an extended case housing a separate pair of pads and providing for the application of water, using the same general principle as that provided for the oil side. Transfer from a "dry" filter to a combination filter and cooler was done simply by turning the water on or off.

In the summer of 1954 a cycoil unit was installed on a 1,600-hp. engine adjacent to the engine using the original evaporative cooler. For comparison both were operated concurrently at identical conditions.

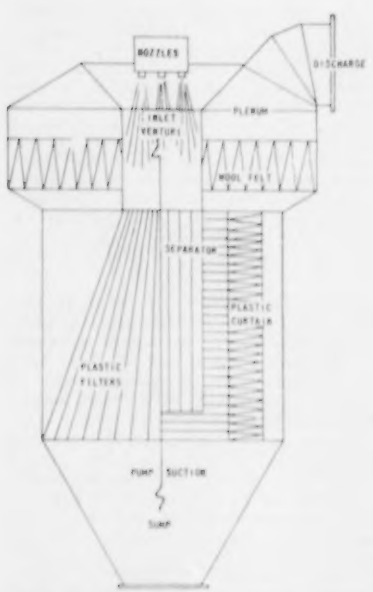
Considerable latitude was granted us by the manufacturer both in method of cooperation and in making minor changes to better serve test requirements. Experience with the original cooler had provided the significant aspects of a completely comprehensive trial. During the series of 24-hour tests, every measurable condition of the two operating engines was observed and recorded.

What determines cooler efficiency? . . . In our original tests, approach to wet bulb had been accepted as the universal index of cooler efficiency. We knew that we had a unit of superior performance by that standard. Historically then, our performance was measured by the relation of cooling efficiency to final airstream temperature. The inspection plate nearest the combustion chamber of the most remote power cylinder was selected as the optimum temperature point.

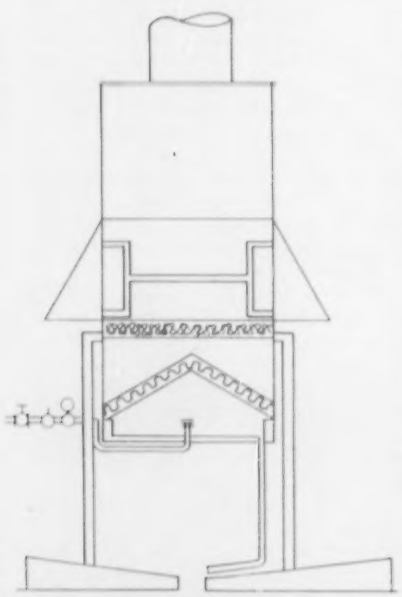
During tests on the original installation, the relation of cooling efficiency to final airstream temperature was uniform in all cases except one.

In the one exception, the alien figures were considered in error, and were deleted from the test data. The phenomena, however, were not disregarded. We immediately began an anlysis of the test data. In all cases where we had sufficient data, the relation of **moisture content** to final temperature was much more uniform than was cooling efficiency to final temperature.

Admittedly, the cooling efficiency of the filter would have a direct relation to the moisture content insofar as atmospheric condition would present approach potential. In the case in question, we had a particularly humid night.



EVAPORATIVE COOLER-FILTER which did good job in reducing detonation but led to corrosion troubles. Fig. 1.

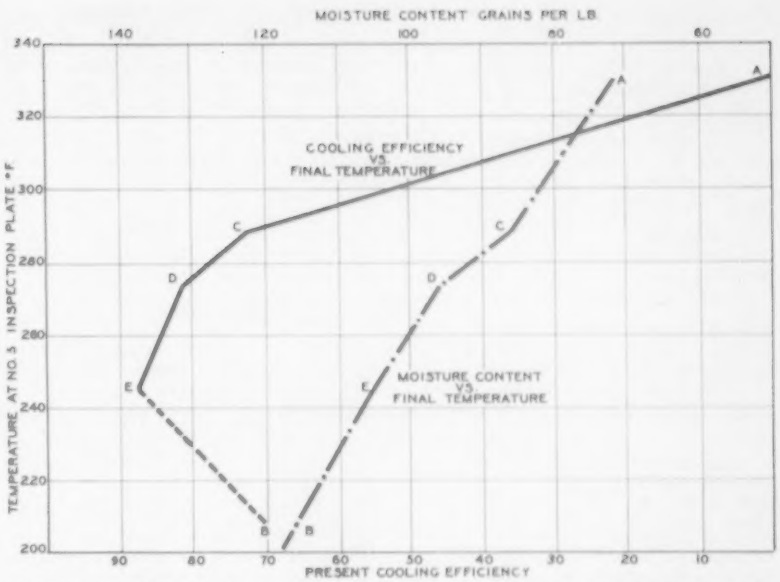


COMBINATION OIL-WATER filter had poor efficiency as cooler but gave lower temperatures at cylinder intake ports. Fig. 2.

And the ambient was such that evaporation and coincidental cooling were at a minimum.

We then superposed on the cooling-efficiency vs. final-temperature curve another curve derived from the same figures but based on moisture content vs. final temperature. This curve, Fig. 3, described a straight line for all practical purposes.

We reviewed the two rejected temperatures and found that they, too, bisected the moisture content vs. final temperature curve. Appended to the cooling efficiency vs. final temperature curve in Fig. 3 is an extension derived from the truant temperature. Obviously, if we accepted this temperature, then the original curve was of no further significance. The moisture-content relation, however, appeared to be quite conclusive.



MOISTURE CONTENT of air stream gives better correlation with final temperature than does cooling efficiency of filter. Fig. 3.

Better cooling, higher efficiency . . . The first parallel tests were made on June 16, 1954, and the results are shown in Tables 1 and 2. The original evaporative cooler-filter still retained its remarkable approach capacity.

Paradoxically, however, the new unit, which performed poorly as an evaporative cooler, showed uniformly lower temperatures of the air stream, both in the butterfly compartments and the cylinder intake ports. This was our first clue to the suppression of detonation by controlled moisture content without regard to temperature depression. Even more significant, for the first time we were showing a measurable difference in B.t.u. per brake horsepower per hour.

Introduction of moisture in the evaporative cooler was completely dependent on the evaporative capacity of the cooling unit. From this it was evident that where induced moisture content was a factor of evaporation, consistent differences in fuel efficiency would depend on natural atmospheric condition.

This was not the case in the combination unit. The amount of moisture admitted to the combination unit was measured against the runoff from the drain. The difference gave the approximate amount going into the scavenging stream. Varying humidity made little difference in the net amount induced into the air stream from the combination unit. Thus, there was no question that we were now applying moisture as finely distributed droplets of water rather than in the vapor state.

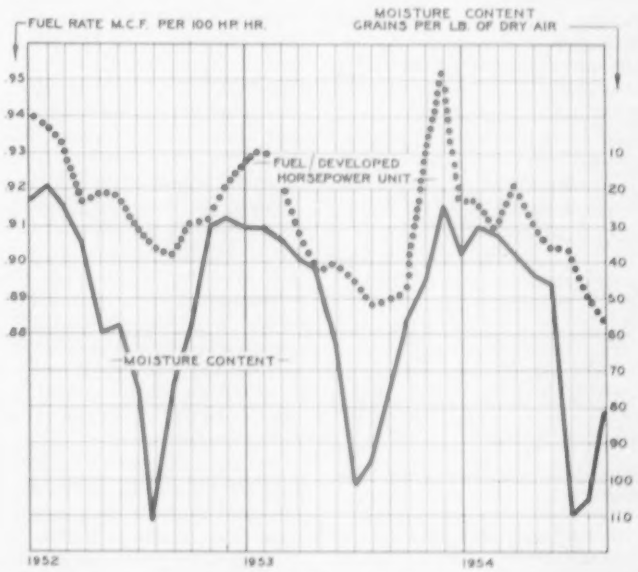
Corrosion and scale . . . This test substantiated our idea that detonation could be suppressed by the addition of a small controlled quantity of moisture. Our next concern was whether we were jeopardizing the equipment by its use.

If the change of state was occurring in and after the compression cycle of the scavenging cylinder, where were the mineral components of the evaporated water collecting? Were they being deposited in the scavenging equipment? Or were they being carried by the air stream to the combustion chamber and ultimately out with the exhaust gases? Meticulous inspection of the scavenging equipment, route of the air stream, piston heads, and walls of the power cylinders disclosed no unusual appearance. So it was presumed that no serious consequence should result.

Tests were conducted for 24 hours using this type application vs. the efficient evaporative cooler. Again we measured a substantial difference in final temperature depression.

Table 1 shows that in the combination unit the air-stream temperature crossed the evaporative filter stream temperature at a lower temperature than required for change of state at the elevated pressure. This difference then increased as the air streams progressed through the areas of flash temperature.

It was apparent that change of state was occurring in most cases within



FUEL RATE over 33-month period follows closely the curve on atmospheric moisture content. Fig. 4.

TABLE 1—SCAVENGING AIR TEMPERATURE TESTS ON NUMBER 6 ENGINE USING THE OLD-STYLE EVAPORATIVE COOLER, JUNE 16, 17, 1954

Time—	10	N 12	2	4	6	8	10	M 12	2	4	6	8
Dry-bulb temperature, °F.	96	101	102	104	98	94	89	84	84	79	68	91
Filter intake, °F. (FI)	98	101	104	106	104	95	93	86	76	79	74	92
Plenum chamber, °F. (PC)	73	76	77	78	77	74	71	70	64	65	64	71
Wet-bulb temperature, °F. (WB)	66	68	68	70	69	68	65	64	62	62	62	66
Efficiency per cent, (FI—PC)/(FI—WB)	78	76	75	90	80	78	78	73	86	88	83	71
No. 2 scavenger discharge, °F.	137	140	142	142	142	140	138	137	133	134	132	136
No. 5 Cyl. butterfly hsng., °F.	191	194	195	192	193	199	196	196	182	184	194	188
No. 5 Cyl. inspection plate, °F.	276	282	280	280	278	290	282	281	278	282	284	270
Rate, M.M.c.f.d.	651	654	655	656	651	656	655	654	654	655	654	655
Horsepower	1,628	1,648	1,644	1,620	1,606	1,676	1,665	1,658	1,660	1,661	1,662	1,540
B.t.u./b.hp.-hr.	9,296	10,096	10,202	9,819	10,151	9,856	10,282	9,995	10,607	10,259	10,162	10,968

Miscellaneous Data

Average r.p.m.	300	Average plenum pressure, in. H_2O (20-in. duct)	—1.25
Average horsepower	1,643	Average scav. air manifold pressure, in. Hg	6.75
Average B.t.u./b.hp.-hr.	10,050	Hours since last overhaul	8,394

TABLE 2—SCAVENGING AIR TEMPERATURE TESTS ON NUMBER 5 ENGINE UISNG THE NEW DUAL-PURPOSE FILTER, JUNE 16, 17, 1954

Time—	10	N 12	2	4	6	8	10	M 12	2	4	6	8
Dry-bulb temperature, °F.	96	101	102	104	98	94	89	84	84	79	68	91
Filter intake, °F. (FI)	98	100	102	99	97	96	95	90	82	90	78	94
Plenum chamber, °F. (PC)	90	89	92	91	89	85	81	79	74	75	70	81
Wet-bulb temperature, °F. (WB)	66	68	68	70	69	68	65	64	62	62	62	66
Efficiency per cent (FI—PC)/(FI—WB)	25	34	29	31	28	39	47	42	40	53	47	53
No. 2 scavenger discharge, °F.	152	156	160	160	157	155	152	150	147	145	142	148
No. 5 Cyl. butterfly hsng., °F.	183	190	192	191	189	190	187	185	178	182	180	179
No. 5 Cyl. inspection plate, °F.	246	250	250	250	250	253	252	248	248	244	244	240
Rate, M.M.c.f.d.	651	654	655	656	651	656	655	654	654	655	654	655
Horsepower	1,628	1,648	1,644	1,620	1,606	1,676	1,665	1,658	1,660	1,661	1,662	1,540
B.t.u./b.hp.-hr.	8,690	9,700	9,558	9,467	9,717	9,634	9,795	9,770	9,759	10,078	9,650	11,080

Miscellaneous Data

Average r.p.m.	300	Average plenum pressure, in. H_2O (20-in. duct)	—3.5
Average horsepower	1,643	Average scav. air manifold pressure, in. Hg	7.25
Average B.t.u./b.hp.-hr.	9,650	Hours since last overhaul	9,258

the scavenging manifold. We could expect the equivalent of an increase in manifold pressure which would serve to scavange the cylinders more efficiently and also have a cooling effect on the internal walls.

Moisture addition no cure-all . . . The theory of moisture content has been challanged by information from areas where detonation is common and humidities high. Actually, it is possible to demonstrate conditions of extreme humidity with moisture content comparable to that at which we experienced detonation in the desert area.

Assume an engine operating at normal full load and at the following conditions in which 6,250 cu. ft. per minute of air is being inspired by the scavenging equipment:

	A	B
Dry bulb, °F.	80	115
Wet bulb, °F.	75	85
Relative humidity, per cent	80	30
Moisture content, gr./lb.	122	134
Specific volume, cu. ft./lb.	14.0	14.9
Air, lb./min.	446.0	420.0
Moisture content, lb./min.	7.8	8.0

We would expect to experience detonation at condition "B."

This is not proposed as a cure-all for the detonation problem in humid areas. Rather it is a possible explanation of apparent inconsistency in the value of moisture to suppress detonation.

Evaporative capacity at conditions "A," either for air cooling or moisture addition, would be almost nonexistent due to the high relative humidity. Mechanical refrigeration to produce the required cooling without humidification would be prohibitive in cost. Significant increase in moisture content, however, again without regard to inlet air stream temperatures, could conceivably be used to suppress detonation.

Final results . . . Summarizing our tests, we could prevent detonation by applying moisture to the air stream if the amount used was equal to or greater than that produced by evaporation. The quantity induced would not be limited by evaporative potential of the ambient air if we injected the moisture in the stream after compression where elevated temperatures and pressures presented a greater capacity. We would experience the equivalent of an increase in manifold pressure if change of state occurred in the manifold area; and should benefit from the endothermic reaction of dissociation.

We then duplicated a manifold inspection plate in clear plastic. We equipped it with an atomizing spray head and installed it just below the thermometer equipment at the inlet of the combustion chamber of No. 5 cylinder.

A series of 4-hour tests were made using this "panic button" vs. dry operation. Injection rate was 0.8 lb. per minute. Depression of final air stream temperatures of 8° to 10° F. resulted.

This prompted us to review the seasonal fuel use at the Blythe plant for a 3-year period. The result of this analysis is shown in Fig. 4. Fuel use has been plotted against moisture content computed from the average daily mean temperature for the 33-month period.

From this, we propose that substantial fuel savings could be had by controlled moisture application during winter operation when the problem of detonation is at a minimum.

A ½-in. copper header has been designed and equipped with eight atomizing spray heads. Each will supply 0.5-1.0 lb. per minute of water fog directly below the inlet of each power cylinder.

This equipment will be used to conduct further tests. During the tests the engines will be accurately indicated with and without moisture injection.

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How to Get Your IDEAS Across

...First you have to make sure, but sure, they're understood

by E. A. Hartsook

HAVE you ever developed a good idea that you were sure would help your company—only to see it killed in "official channels" before it had a chance to be tried?

If you're like most other engineers, you've probably had at least one such sad experience. And you've probably put the blame for smothering your idea on red tape, an unfriendly superior, or poor top management. But did you ever think of the most likely cause of all—poor communication on your part? Are you positive that the right people really **understood** your idea . . . realized its value . . . believed that it was actually workable?

Quite possibly they didn't. Your report, or memo of recommendation, or brief oral mention may never have gotten your idea across effectively. After all, these men are usually snowed under by reports, memos, and comments. You need a more direct, more forceful way to express ideas in the modern industrial world. And that way is illustrated oral presentation.

This may sound involved—"illustrated oral presentation." But it really isn't. It doesn't require the elaborate graphs of a Fortune Magazine article or the golden voice of an orator. What it does require is a little extra work to produce a balanced idea that's soundly organized and simply but effectively illustrated. And it requires willingness to view presentation as an opportunity, not an obligation.

Analyzing your idea . . . Your first job is to make sure that your idea is well balanced. That it's not only desirable and workable, but economically practical as well. To do that you must check the accuracy of your estimates of need, cost, and benefit.

In short, will using your idea increase the efficiency of your company's overall operation? Will the expense of putting your idea into action be justified by later savings? Is the benefit to be gained great enough to overcome any minor objection that may arise?

Finally, are you answering these questions honestly? No presentation will be effective unless the audience has confidence in the speaker. So remember—the techniques of salesmanship must build on personal integrity. And to be believable, the techniques used must always be natural and consistent with the character of the author.

Once you've checked the accuracy of estimates and gathered the data to back them up, you have a vital job of orientation to do. You have to put yourself in the position of those who'll evaluate your ideas. You'll have to express your ideas in terms of **their** interests if you hope to get them across most effectively.

For example, you may have to get the approval of a board consisting of two engineers, an accountant, and a lawyer. The engineers will want to know how your idea will increase work efficiency. But the accountant will be more interested in how it will affect his profit and loss statement. And the lawyer will be concerned about possible patent infringement.

So your talk should appeal to the interests—and meet the objections—of engineer, accountant, and lawyer. That isn't as difficult as it may seem. You've already checked into the engineering and cost-and-savings aspects. You now must check with the company's legal department to make sure that your idea has no legal complications. Then you have each segment of your audience covered and can prove the worth of your idea in terms of each group's particular interests.

Certainly this example might be much more complicated—or much simpler—than your actual situation. Perhaps only your immediate supervisor will be the man whose decision will put your idea into action. Or maybe your idea is so far-reaching that it will demand presentation before a much wider range of executives, including the sales manager, research director, etc. Whatever the case, your problem will be the same: to make sure that your ideas are clear to every group in your audience, and to express those ideas in terms that will be personally meaningful to those who will judge them.

Once you've gathered the information and adopted the attitude that will achieve these two goals, you're ready to start planning the step-by-step outline of your talk.

Organizing your talk . . . Let's say that all this basic information is stacked up on your desk in a pile of data sheets, reference books, reports, and drawings. How do you go about sorting it all out into a brief, organized presentation?

Well, you begin by reducing the whole complex mess to its simplest terms! Your idea was probably conceived as a solution to a problem. So, for a bare idea outline, why not use the "problem-solution-result" technique? Start in with the problem. In its simplest terms, what is it? What is its cause? And what are its undesirable results? Answer each of these three questions with a single, simple sentence that gives the gist of each answer in as few words as possible.

Now for the solution—your idea. What is it? How does it eliminate or overcome the causes of the problem? Is it practical from an economic standpoint? What, if any, are its disadvantages and how are they offset by greater advantages? Answer each of these questions too in a single brief sentence that you can later substantiate with supporting data.

Finally, how about results? Will your solution reduce the manpower required to do the job? Reduce the material costs of doing the job? Result in greater production or efficiency? List each of the

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Material from a paper presented at a recent A.I.M.E. meeting in Los Angeles.

results you anticipate in one sentence—and you've completed your basic job of organization. You also have the framework of your talk.

This simplification can be done with any problem. If you have serious trouble, your idea is simply not yet thought out.

Now your job is to back up each of these simple, single-sentence statements with facts and figures. What kind of facts and figures? Here's where your audience and your attitude come in—because you now carefully choose from your assembled data the facts and figures that will appeal to the interests and answer the objections of the men who'll decide on the merit of your idea.

In short, for the engineer you provide the engineering data that will substantiate what you say. For the others—the accountants, the lawyers, the salesmen, etc.—you provide the specific information that will fill their needs. And in adding each segment of substantiating information, you must carefully hold it to the minimum amount that will do the job. In effect, you balance your supporting details so that they will satisfy the requirements of each group in your audience, and yet not be too lengthy or too technical to bore the other groups you're addressing.

When that's done, you have your bare outline filled in with the facts and figures that prove the merit of your ideas. Mechanically, the outline is complete enough to base your talk on. But we have yet to check one vital element—the human element. Perhaps your techniques, figures, and logic will pass every test of a fair, disinterested analysis. But will they also take into account the personal preferences, the prejudices, and the habits of the men who will evaluate your idea?

This may seem to be a silly thing to have to worry about. But you'd better. Because unless you can overcome at least the most serious of your audience's prejudices, you might find your ideas rejected completely because of one or more minor points.

For example, let's say that your idea involves the use of a Widgit pump as one key unit in a processing scheme. It's a good pump and you know it—but your supervisor hates the mention of the Widgit name. One of their pumps failed him 15 years ago, and he's refused to use another one since then. So the minute he sees the specification of a Widgit pump, he doubts the wisdom of your equipment choice. And he goes on from there to find other "flaws" in your scheme. Finally, even though it isn't fair, he rejects your whole scheme as unworkable.

Sound ridiculous? It certainly is. But people are like that—and often on more serious prejudices than this. So your last job in checking your organization is to make ample allowance for the peculiar bias of your audience. Go over the things you've learned about the personal preferences and prejudices of each member, or each group, of your audience and make allowance for them in all minor points where a light shift in your method or means might avoid a clash.

After all, you're trying to sell an idea—not a complete, inflexible plan. So leave room for, even **invite,** specific suggestions from members of your audience on such minor matters as equipment, execution, or timing. Concentrate on getting your idea approved—and don't let the human element block its success because you failed to reckon with it.

As you complete your organization work, be sure you are answering two key questions:

1. What is the idea all about and why is it important?
2. What **action** do you want from your audience?

These are too often forgotten or buried in rambling material—and unless they are clear, the whole thing may fall flat.

Illustrating your talk . . . Now that you have thoroughly checked your outline for organization, accuracy, audience appeal, and tactfulness, and impact let's get to the matter of illustrating it. Certainly you're fully aware of the value of illustration in adding life to a talk and graphically illustrating its strong points. But just how do you go about choosing and preparing the illustration you'll use?

Basically, it's simple. Since you already have your bare idea outline written, the first step is to pick from four to six of your outline points and illustrate them. You choose those points which best meet two requirements:

1. They must graphically summarize your whole idea and its factual evidence.
2. They must lend themselves to simple, eye-catching illustration.

With these two requirements in mind, check over the key ideas in your outline. Then select those you think will best do the job, those which will put your idea and its factual backing in a nutshell. Now you have to decide how to illustrate them and how to prepare that illustration.

As you know, there are many ways to illustrate key points. You can use bar charts, curves, drawings, photos, numbered outline sequences, etc. But whichever you choose as best suited for getting your idea across, here are nine basic suggestions that will help you make them more effective:

1. **Use only one illustration for one idea.** Each of your key points is one idea. And the human mind is capable of grasping only one idea or principle at a time. So limit each illustration to a single point that will stand by itself. Don't let it imply other matters which will detract from its effectiveness. Make it a complete idea in itself.

2. **Limit the number of illustrations to six or fewer.** If you've carefully chosen only those key points that summarize your idea quickly, you won't need more than six major logic steps **or** illustrations. Any more than this will either confuse or bore your audience. So reduce your number of illustrations as much as possible, just as you reduced the number of key points in writing your bare idea outline.

3. **Use short, clear titles.** Keep the title of each illustration down to as few words as you can. Make those words simple, direct, and thought-provoking—a quick expression of the point you are illustrating. Consider, for example, the following: "Summary of Operating Variables Under Various Contractural Conditions Appraising New Programs A, B, and C." This is pure gobbledygook. Yet we see it all too often (and the above comes from an actual chart). Improvement takes the direct route: "Gain to Company Under Plan B."

4. **Use action verbs in titles.** Nothing is so static as a "label" title that lacks the action and interest of a positive verb. In the first title example, we help the disinterested audience stay that way. Improvement comes when we call pointed attention to a real item of audience interest—GAIN. Depending on the audience, a more informal but equally active title such as "How This Will Increase Profits" may be effective.

5. **Use clear labels and few words.** As a good news picture uses small captions, or no caption—a good illustration uses the picture to get its story across. Explanations and wordy discussions simply confuse. So emphasize the picture and play down the words.

6. **Put motion into your illustration.** Since the eye moves from left to right across a placard and from top to bottom, arrange your elements of illustration to move in those directions, too. Make the thought you're illustrating build up to conclusion either from left

to right or from top to bottom. For example, a rising curve does this, as does a gradually increasing width of bars on a horizontal bar chart. The psychological advantage of this conscious parallelism with the reader equals intuitive approach, is well worth the trouble to design wherever possible.

7. **Use bright colors and color simplicity.** Colors—bright, basic colors like red, green, or blue—can add much to the eye-catching ability of your illustrations. But you have to be careful to use them properly. First of all, they must be functional. They must be useful in making the key idea pop out of the illustration, such as a rising curve shown in red would do. Second, they must be used simply; never more than three in one chart. And third, put your favorable principles in bright colors and any contrary or contrasting principles in dull colors or black. In other words, make color bring out the ideas you want emphasized clearly and sharply.

8. **Provide a simple and logical carryover from one illustration to another.** Either write your titles to tie in together as one complete story, or use a numbered sequence, or adopt a uniform design pattern, or do something similar to give the charts unity and continuity in appearance. The important thing is that you get each principle in your outline to link together in an obvious chain of logic that leads to the conclusion you're trying to make. These carryover devices will strengthen that chain.

9. **Choose, and use, illustrations for variety.** Make sure that your illustrations vary in type so they won't be monotonous to present. For example, six straight bar charts would make for dull illustration. So would three or more of any one type of illustration in a six-unit group. Work in as many different types of illustration as you can so your audience will continually be confronted by a different kind of illustration—first a lettered summary, then a graph, then a blowup drawing, etc.

Why all this bother? . . . It may easily seem that taking all of these steps and following all these suggestions is the hard way to go about selling an idea to management. It may seem especially so when the only people you have to sell your idea to are immediate supervisors whom you contact daily. But quite the opposite is true.

Whether you're trying to sell your ideas to one man or a hundred, you still face the same basic challenge of communication. You still have to make your audience understand your idea, realize its value, and believe in its workability. The odds against you may vary—but they're always against you.

If you hope to get your idea across, to have it put into action as you believe it should be, you have to overcome these odds. And you can do that only by preparation. The more preparation you put into your presentation, the more you juggle the odds of its acceptance in your favor.

How much are your ideas worth to you? How much will they help your company? How much will their successful adoption help you to advance in your work and to build a more secure future? Surely they're worth a few extra hours or days of preparation. Then put this preparation into a real effort to get them across. Invest concentration and effort—and reap dividends of ideas effectively sold.

SHORT PIPE and nipples combine to form these jacks that support odd-shaped pieces during fabricating.

Shop-Made Jacks Solve Welding Problems

WHEN fabricating large sections of pipe and fittings for installation in a plant, it is frequently a difficult task to support odd-shaped pieces while welding.

At Sunray Oil Corp.'s Benton, La., gasoline plant, a number of shop-made jacks have proved to be a satisfactory solution to this problem.

The jack consists of a short pipe, ¾ to 1½ ft. long. This is supported in a vertical position by three welded nipples which form a tripod base. The vertical length of pipe is equipped with a telescoping member which may be either a threaded shaft or a smaller-diameter length of pipe.

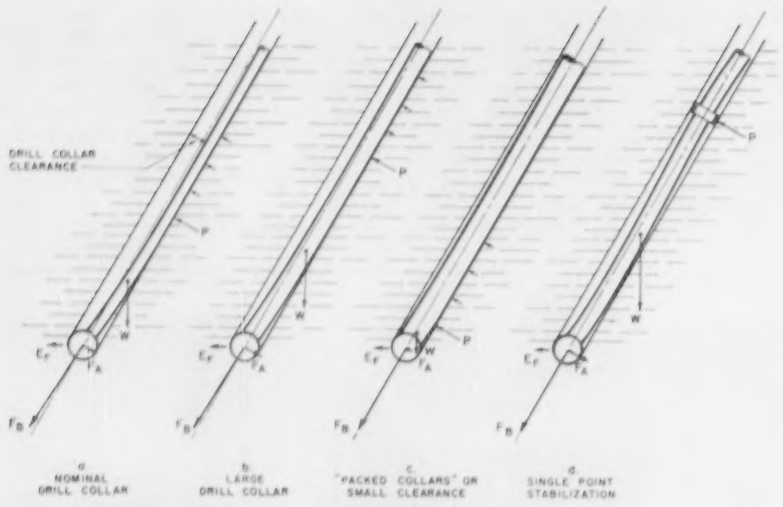
With the threaded shaft, a nut with a short handle welded to one side is used to vary the height of the telescoping member. By adjusting the nut to a desired position on the threaded shaft, and having the nut rest on the vertical length of pipe, the topmost portion of the telescoping member may be held at any level necessary.

When two concentric pieces of pipe are used, a hole drilled in the outer member is surmounted by a welded nut. A threaded shaft screwed through the nut may be used to exert pressure on the inner pipe similar to a set screw. Thus the inner member is raised to the desired height and the shaft made up tight. A small bar is welded to the shaft to form a crosspiece so it may be made up by hand.

A final item on the jacks is a short length of angle iron welded to the top of the telescoping member. This is welded with the open part upward to form a cradle for supporting the pipe being worked on.

In using the jacks, they are placed conveniently beneath the pipe as it is being fabricated. Varying the height of the telescoping member insures that the pipe will be held level, even when welding on a surface—such as a dirt yard—where the floor will vary considerably.

As the additional portions are added to the piece being fabricated, more jacks can be used to handle the entire unit. They may also be placed in any position to compensate for the odd shapes of the fabrications.



Factors that affect hole deviation . . . Fig. 1.

Crooked Holes—And How to Help Them Go Straight

. . . with emphasis on drill-collar size and stabilizers

by John W. Speer and George H. Holliday

Part 1

THE AUTHORS SAY . . .

● Weight on bit to maintain a constant deviation varies approximately as the 2.5 power of the drill-collar diameter within the limits of drilling weights used in normal field practice.

● Use of drill-collar stabilizers placed properly with respect to the bit permits an increase in weight on bit while maintaining a constant deviation. The magnitude of weight increase appears to be on the order of 60 per cent for conditions of moderate weight on bit and hole deviation.

● Influence of drill-collar size on weight of bit to maintain constant deviation when stabilizers are used is less than the influence of non-stabilized collar size.

● Stabilizer placement with respect to the bit for optimum control deviation probably varies with drill-collar size, drill-collar and stabilizer clearance, hole angle, and weight on bit; however, this optimum position does not appear critical as a large improvement in deviation control results from a stabilizer placed within a relatively wide interval above the bit.

● Optimum stabilizer position for conditions of 9½-in. drill collars in 10⅝-in. hole, 10⅜-in. stabilizers, and 35,000± lb. weight on bit is approximately 70 ft. above the bit. Stabilizer positions within the interval 45 to 110 ft. for 7¾-in. to 9½-in. drill collars and nominal drilling weights produce relatively good results.

● The use of multiple stabilizers immediately above the bit ("packed hole stabilization") results in consistent but low rate of deviation increase. The rate of deflection increase is related to stabilizer clearance, drill-collar size, and weight on bit. Optimum results are obtained with zero clearance.

● Packed-hole stabilization is a useful method for controlling deviation in drilling short, crooked-hole intervals.

THE control of hole deviation and difficulties that can be increased when deviation is not controlled are among the most costly problems associated with oil-well drilling. The often-used practice of reducing drilling weight to prevent excessive deviation can greatly increase cost through attendant low drilling rates. More obvious is the cost of not controlling deviation when reflected by keyseat trouble and subsequent fishing of stuck pipe. Consequently, methods of controlling deviation which do not interfere with drilling progress can contribute materially to reductions in drilling cost. It is the purpose of this report to show these methods through discussion of factors that affect deviation and analysis of field results.

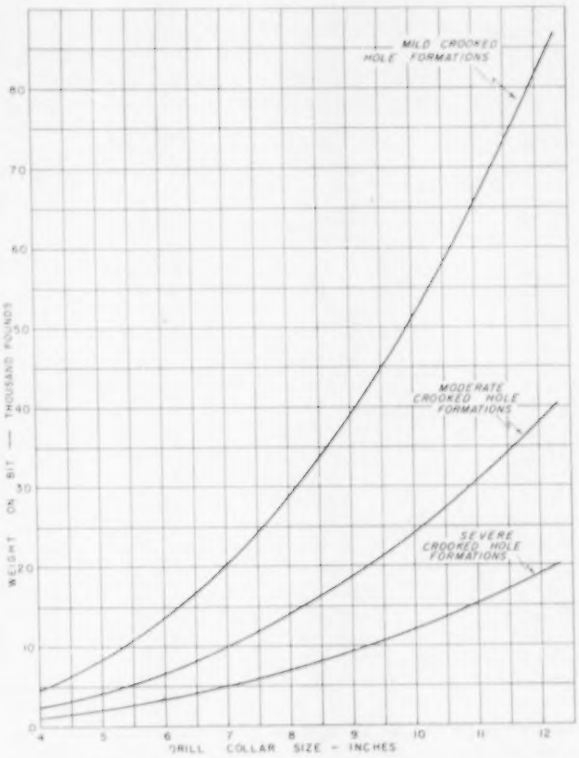
Factors That Influence Hole Deviation

As a vertical drill string cannot resist lateral forces, it is impossible to drill a vertical hole under oil-field conditions. Consequently, a discussion of factors that affect hole deviation is concerned only with an inclined hole. In a straight inclined hole, the drill-collar string is centered in the hole at the bottom by the bit but deflects or sags to the low side and contacts the wall of the hole at some point above the bit. With no weight on the bit, the only force acting on the bit is the resultant of the weight of the drill collars below the contact point. This force tends to bring the hole back to vertical.

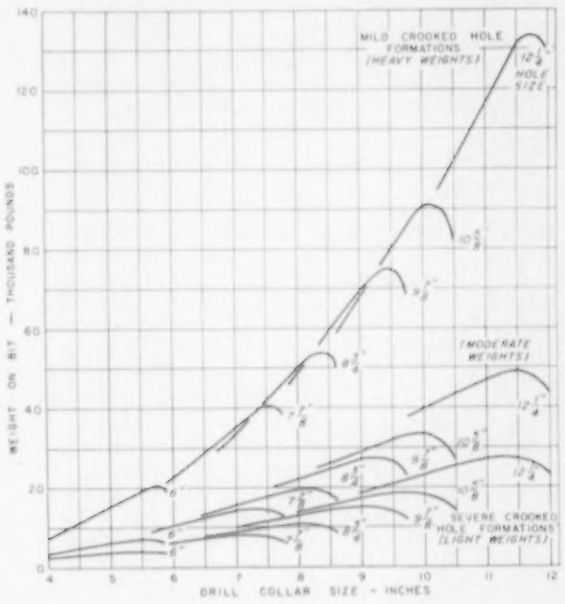
When weight is added to the bit, as shown in Fig. 1-a, the weight of the drill collars below the point P provides a force F_A which tends to bring the hole back to vertical; however, the weight on bit F_B is in effect applied from the contact point P to the bit at an angle greater than the angle of the hole which tends to increase deviation. In the absence of interference from the formations penetrated, the resultant of forces F_A and F_B would determine the angle at which the hole drilled. The formations penetrated can contribute substantially to deviation tendency, however, and must be considered even though the nature of its effect is not known. As it is primarily of concern when contributing to hole angle, formation influence is included here as the factor E_F tending to cause deviation.

Assuming that the formation influence E_F cannot be varied, deviation tendency can be reduced by increasing the force F_A, reducing F_B, or reducing the angle at which F_B is applied.

The authors are with Shell Oil Co. at Los Angeles and Farmington, N. M., respectively. Paper presented at spring meeting, Pacific Coast district, A.P.I. Division of Production, Los Angeles, under the title, "Influence of Drill-Coller Size and Stabilizers on Deviation Control."


MILD CROOKED HOLE FORMATIONS
MODERATE CROOKED HOLE FORMATIONS
SEVERE CROOKED HOLE FORMATIONS
WEIGHT ON BIT — THOUSAND POUNDS
DRILL COLLAR SIZE - INCHES

INFLUENCE OF DRILL-COLLAR SIZE on weight on bit to maintain constant hole deflection (½-in. clearance; 3° hole deflection). **Fig. 2.**


MILD CROOKED HOLE FORMATIONS (HEAVY WEIGHTS)
HOLE SIZE
(MODERATE WEIGHTS)
SEVERE CROOKED HOLE FORMATIONS (LIGHT WEIGHTS)
WEIGHT ON BIT — THOUSAND POUNDS
DRILL COLLAR SIZE - INCHES

OPTIMUM DRILL-COLLAR SIZE for various hole sizes (influence of the combination of clearance and collar size on weight to maintain constant 3° deflection; approximately applicable for other deflections). **Fig. 3.**

The force F_A for any given hole angle is a function of the weight of the drill collar string below the contact point P, consequently, a function of the distance from the bit to P and of the weight per unit length of the drill collar. The force F_B is a direct function of weight on bit and responds accordingly. The angle at which F_B is applied depends on drill-collar clearance and on the distance from the bit to the contact point P. Thus, deviation tendency can be influenced through several methods.

Decreasing weight on bit causes a corresponding decrease in the force F_B and also a decrease of bending moment in the drill collar. Decrease in bending moments results in increase in the distance from the bit to the contact point P, which reduces the angle at which F_B is applied and increases the straightening force F_A. Thus, decreasing weight on bit effectively reduces hole-deviation tendency; however, this can be a costly remedy because it usually results in slower penetration rates.

Drill collars . . . The size of the drill collars determines section modulus or stiffness and weight per unit length of the drill collar. Section modulus influences the distance from the bit to the point at which the drill collar contacts the wall of the hole. Consequently, increases in drill-collar size, as shown in Fig. 1-b, result in increases in weight per unit length as well as length of drill collar that contributes to the straightening force F_A. In addition, the increase in distance to the point of contact P results in a decrease of the angle at which weight on bit F_B is applied, which further reduces deviation tendency. Drill-collar size therefore substantially affects deviation tendency.

The theoretical influence of drill-collar size on weight on bit to maintain a constant deviation, as derived from works of Lubinski and Woods,[1] is shown in Fig. 2. Three curves which represent conditions of various crooked hole tendencies are plotted to give weight on bit to maintain a 3° deviation for various drill-collar sizes with a constant clearance of 1½ in.

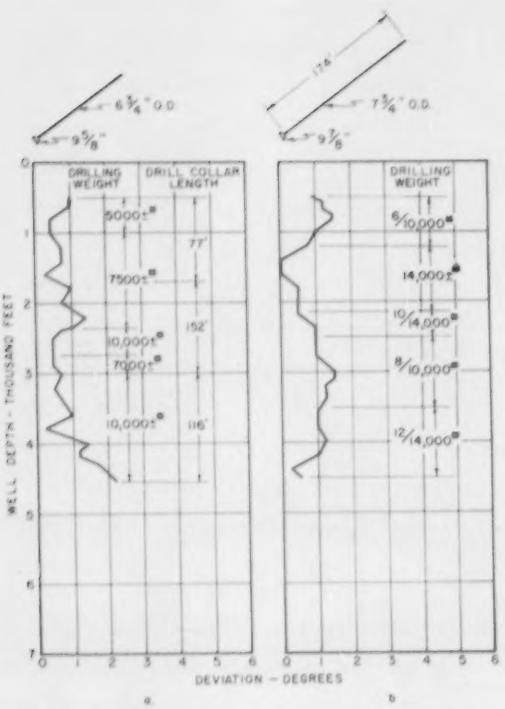
The relationships are also approximately good for other deflections. As these three curves belong to a family of curves for an infinite number of similar relationships, the designations of crooked hole tendency are for reference only. These data indicate that weight on bit for a constant deviation varies approximately as the 2.5 power of the drill-collar diameter.

Drill-collar clearance determines the amount of drill-collar deflections required to contact the wall of the hole and also influences the angle at which weight on bit is applied. Amount of deflection required influences the distance from the bit to the point of contact with the wall of the hole, thereby influencing the straightening force F_A. Increases in clearance result in increases in the angle of application of weight on bit which contributes to deviation; however, the distance to the contact point P and, consequently, straightening force F_A are also increased by the same procedure. As a result, drill-collar clearance contributes to opposing forces.

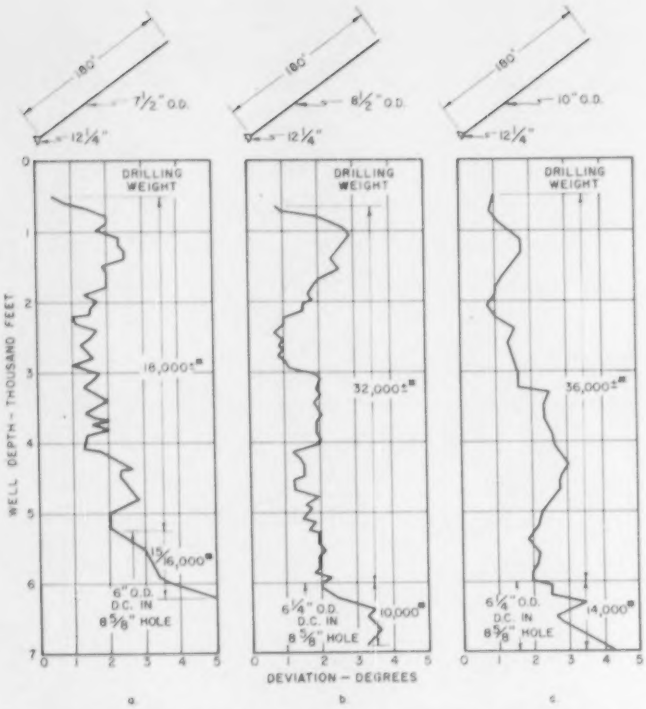
For clearances less than certain limits which are a function of weight on bit, decreases in clearance result in increases in deviation.[1] The limits of clearance below which further decrease adversely affects deviation tendency vary inversely as weight on bit and are greater than clearances used in field practice except for very heavy weight.

For a constant hole size, increases in drill-collar size and the corresponding decreases in clearance cause opposing effects which determine an optimum drill collar for a given hole size. This relationship, as derived from works of Lubinski and Woods,[1] is shown in Fig. 3 by curves plotted to give the weight on bit with various drill collars to maintain a constant 3° deflection in several of the more popular hole sizes. The curves also are approximately good for other deflections.

It is indicated that for conditions of



INFLUENE OF DRILL-COLLAR SIZE on drilling weight to maintain low deviation, Brea field. Fig. 4.



INFLUENCE OF DRILL-COLLAR SIZE on drilling weight and hole deviation, Ventura field. Fig. 5.

severe deviation tendency, wherein light drilling weights are required to maintain a 3° deviation, the optimum drill-collar size for maximum weight on bit is approximately 1 in. less than hole size. For progressively greater drilling weights, optimum drill-collar size more closely approaches hole size and is indicated to be approximately ½ in. less than hole size where relatively heavy weights are used. For normal drilling conditions, therefore, the largest drill collar that can be used safely should provide optimum deviation control.

It is also shown in Fig. 3, by the weights that can be used with a given drill collar in various hole sizes, that the influence of clearance within the limits of normal field use is small. However, if drill collar size is increased beyond the optimum, as shown in Fig. 1-c, the tendency to drill a vertical hole is appreciably reduced. For small clearances the drill collar must deflect only slightly to contact the wall of the hole; consequently, the point P is near the bit and the straightening force F_A is small. Even though the weight on bit F_B is applied at approximately the angle of the hole, the influence of the formation E_F is unaffected, and as the resisting force F_A is small the resulting tendency is to increase deviation.

Because of the close clearance, however, the rate of increase of deviation is relatively small. Very small clearance obtained through the use of stabilizers is useful as a method of deviation control in drilling relatively short intervals where deviation tendency is severe.

The use of a stabilizer or centralizer in the drill-collar string, as shown in Fig. 1-d, decreases the angle of application of weight on bit F_B to the angle of the hole and increases the length of the drill-collar section that contributes to the straightening force F_A. Thus, one of the factors that adds to deviation tendency is nullified, and only the formation effect E_F must be surmounted. The proper use of a stabilizer should, therefore, substantially affect deviation tendency.

As part of the benefit obtained through the use of a stabilizer results from elimination of the adverse effect of weight on bit, percentage improvement should vary accordingly, being greater for conditions of heavy weights than for light weights. Also, as weight on bit influences only the position of the stabilizer through the bending moment, increases in weight on bit should not increase deviation as much as with nonstabilized drill collars.

From inspection of Fig. 1-d, it appears that maximum straightening influence should occur with the stabilizer placed to permit the deflected drill collar to almost contact the wall of the hole, thereby providing maximum length of drill collar below the contact point P and maximum straightening force. It follows that weight on bit through bending moment, drill-collar size which is synonymous with stiffness of collar, and drill-collar clearance would affect the position of the stabilizer in much the same way as they do the contact point P of nonstabilized drill collars.

The deviation tendencies resulting from weight on bit and the influence of clearance on the angle of application of weight on bit are no longer effective if the stabilizer is hole size. There should, therefore, be an optimum stabilizer position for each condition of weight on bit, drill-collar size, hole angle, and clearance of drill collar and stabilizer.

There probably are several factors, such as rotation of the drill string and bit type, that affect deviation tendency. These are not included here because of the inability to define their effects and because it is felt that these effects are relatively small.

Field results . . . Data were selected to show influence of the various factors for similar or equal hole deviation with weight on bit demonstrating the influence. For this reason, the field results shown were only part of those available for study.

Drill-collar size . . . It was shown in the above discussion that the drill-collar size should substantially affect deviation tendency; whereas, drill-collar clearance within limits of normal field use should demonstrate only a small

influence. For this reason, drill-collar clearance was omitted from the following discussion.

Drilling-data comparisons which indicate the influence of drill-collar size on weight on bit to maintain a constant deviation are shown in Figs. 4, 5, and 6. These figures consist of deviation plots for wells drilled in three fields with various drilling weights and sizes of drill collars. Dimensions of the drill-collar string, hole size, and weight on bit are shown for each well or group of wells. The wells used in each comparison penetrated approximately the same stratigraphic intervals, which is substantiated by the similar character of the deviation plots.

Results given in Fig. 4 for the use of 6¾ and 7¾-in. drill collars in a field where a low deviation was required show that for an average hole deviation of approximately ¾°, an average weight on bit of 12,000 lb. was used with the 7¾-in. drill collar, as compared to an average 8,000 lb. used with 6¾-in. drill collar. It is indicated also that the use of 10,000 lb. with the 6¾-in. drill collar below 3,000 ft. increased the angle to greater than 2°. Data comparisons given in Fig. 5 for the use of 7½, 8½, and 10-in. drill collars in 12¼-in. hole show that similar hole deviations were obtained with drilling weights of 18,000, 32,000, and 36,000 lb., respectively. Noted also is that the deviation increased in each of the wells when hole size was reduced to 8⅝-in. and 6 to 6¼-in. drill collars used with drilling weights of 10,000 to 15,000 lb.

Fig. 6 shows results obtained from the use of 6¼-in. drill collars in 7⅞ and 9-in. hole, and from 8-in. collars in 9-in. hole in a southern Oklahoma field.[2] For comparable deviations, weight on bit was doubled through the use of 8-in. drill collars in comparison with 6¼-in. drill collars.

Pertinent information from these and similar comparisons is summarized in Table 1. Using averages of these data, a comparison of calculated influence and field results is shown in Fig. 7 for the relationship between drill-collar size and weight on bit to maintain constant deviation. The three curves given in Fig. 2 are shown with three relationships derived from field results. It is indicated that calculated influence of drill-collar size compares closely with field results; that is, weight on bit to maintain a constant deviation varies as the 2.5 power of drill collar diameter.

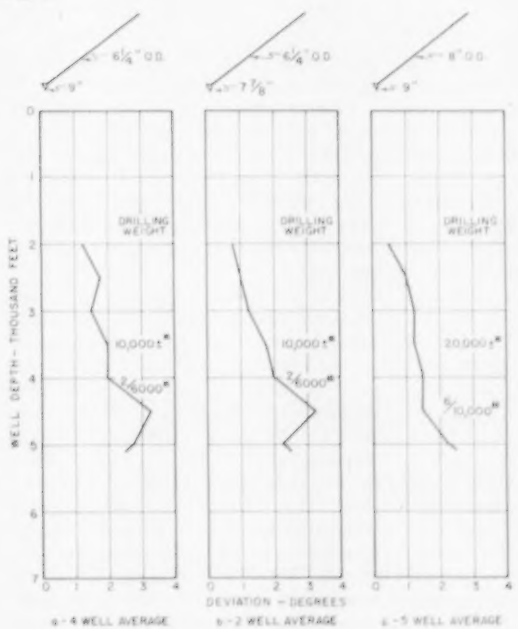
TABLE 1—INFLUENCE OF DRILL-COLLAR SIZE ON DEVIATION CONTROL

Field—	Figure or well	Depth interval (ft.)	Hole size (in.)	O.d. drill collars (in.)	Average deviation (deg.)	Average drilling weight (lb.)
Brea	4a	500/4,000	9⅞	6¾	¾	8,000
	4b	500/4,000	9⅞	7¾	¾	12,000
Ventura	5a	500/5,000	12¼	7½	2	18,000
	5b	500/5,000	12¼	8½	2	32,000
	5c	500/5,000	12¼	10	2	36,000
	A	1,500/3,200	10⅝	7¾	2½	22,000
	B	1,500/3,200	10⅝	8⅞	2½	25,000
So. Oklahoma	6a	2,000/4,000	9	6¼	1¾	10,000
	6b	2,000/4,000	7⅞	6¼	1½	10,000
	6c	2,000/4,000	9	8	1¾	20,000
	6a	4,000/5,000	9	6¼	2¾	2/6,000
	6b	4,000/5,000	7⅞	6¼	2¾	2/6,000
	6c	4,000/5,000	9	8	1¾	6/10,000

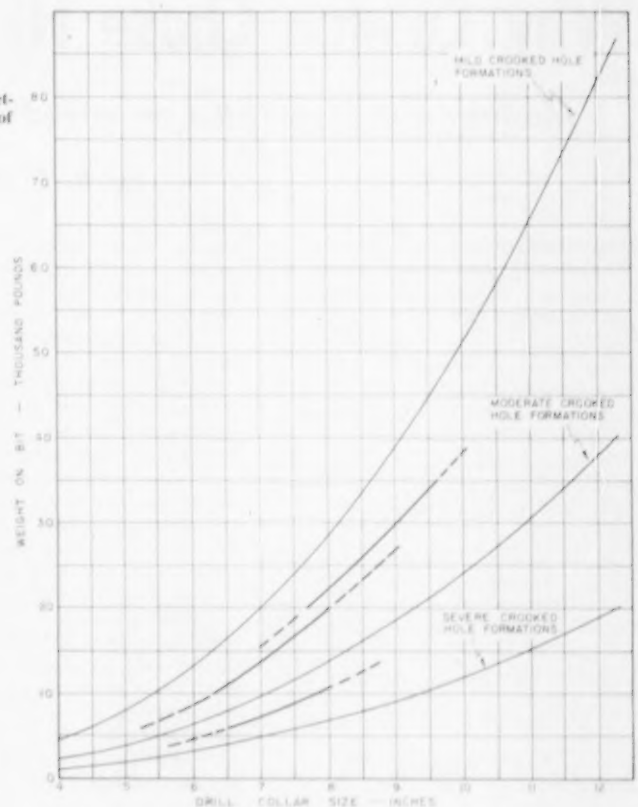
References

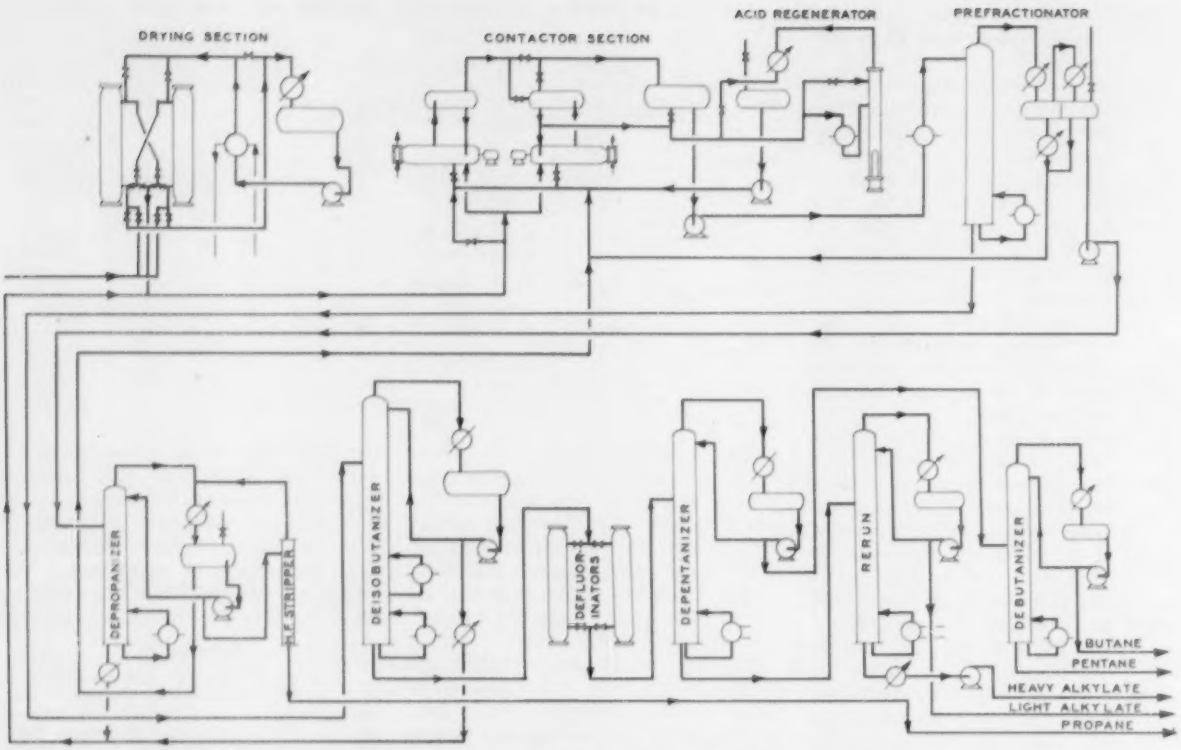
1. Woods, H. B. and Lubinski, Arthur, "Practical Charts for Solving Well-Bore Deviation Problems": presented at A.P.I. meeting, Division of Production, Oklahoma City, March 17-19, 1954, Oklahoma City.
2. Booth, W. M., "Oversized Drill Collars Aid in Crooked-Hole Country": The Oil and Gas Journal, August 4, 1952.

INFLUENCE of drill collar size on drilling weight and hole deviation, Arbuckle uplift — southern Oklahoma. Fig. 6.



COMPARISON of theoretical and field data-effect of drill-collar size. Fig. 7.


MILD CROOKED HOLE FORMATIONS
MODERATE CROOKED HOLE FORMATIONS
SEVERE CROOKED HOLE FORMATIONS
WEIGHT ON BIT – THOUSAND POUNDS
DRILL COLLAR SIZE – INCHES



MIXED FEED is used by Cosden's HF alkylation plant at Big Spring, Tex. Note position of defluorinators following deisobutanizer. Fig. 1

Why Cosden Chose HF Alkylation

Modern plant operates on mixed feed, uses horizontal contactors

by A. R. Orr

THE new HF alkylation plant of Cosden Petroleum Corp. at its Big Spring, Tex., refinery was designed to process slightly over 2,400 BPSD feed, but in capacity tests it has run at over 3,000 bbl. per stream day with the same produced quality. This plant departs from normal HF plant practice in a number of respects:

1. Instead of conventional butylenes-only alkylation, a mixed feed is used. The result is increased volume of alkylate made.

2. Horizontal contactors with mixers are employed. One advantage is lower structure costs. There are other improved features. Two contactors are operated in series but manifolding is such that they can be run individually or in parallel.

3. Defluorinators are located following the deisobutanizer. Thus only the product streams are defluorinated. This makes possible reduction in equipment size.

4. The deisobutanizer operates with two stages of heating. One reboiler uses 50-psi. exhaust steam, the second 170-psi. steam from the boiler plant. A third source of heat for other units is a hot-oil circulating system.

5. Plant is characterized by low acid consumption—averaging 0.19 lb./bbl. of alkylate during past 7 months. This is attributed to high isobutane-to-olefin ratio, high acid purity and location of defluorinators.

Last July 4, Cosden started on stream with its new U.O.P.-designed and licensed HF alkylation plant. We, as were many other people, were somewhat nervous about working with any material as difficult to handle as HF acid. However, construction materials and methods have changed with experience. As a result, the Cosden HF plant differs radically from most of the earlier wartime plants.

Cosden chose HF rather than sulfuric acid on the basis of economics existent at the Big Spring refinery. Disposal of spent acid from a sulfuric plant at Big Spring appeared to be practically impossible, and no economic means of regeneration was available at the time.

How did Cosden approach the operation of such a plant? Several weeks before startup time, the men who were to operate the plant were transferred to it to begin a program of training in operating techniques and safety procedures. Available literature from the manufacturing of HF acid and operating manuals of U.O.P. were made available. These treated fully the operating techniques and safety programs recommended by U.O.P. HF-experienced personnel. Trips to operating HF plants were made so that the operators could observe for themselves the procedures

Author is with Cosden Petroleum Corp.
Paper presented at Big Spring, Tex., regional meeting of Western Petroleum Refiners Association, 1955.

Due to high isobutane-to-olefin ratio, high acid purity and location of defluorinators the Cosden plant has experienced a low acid consumption—averaging 0.19 lb. per barrel of alkylate.

involved. We believe the extra time and expense has paid off many fold.

Mixed Feed

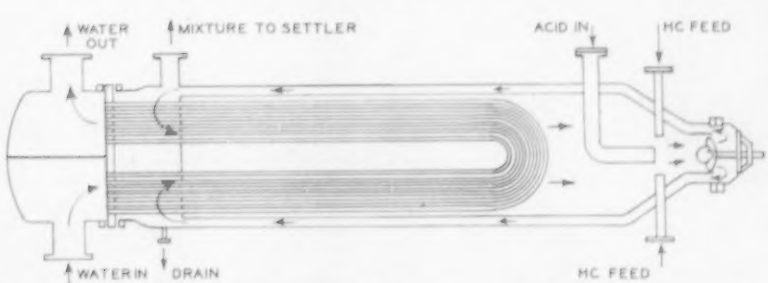
The chemistry of HF alkylation is straightforward, but mechanics of the process may be varied greatly. Alkylation of butylenes only has been the accepted standard for years in producing avaiation alkylate of the 115/145 grade.

Cosden departed from the usual in this case. By using a mixed olefin feed, volume of alkylate produced could be increased considerably using only the feed available from other refinery operations. The result was design and construction of a plant to process a mixed stream to produce the maximum volume of aviation alkylate. Table 1 shows a typical analysis of recent feed streams to the plant.

TABLE 1—HF ALKYLATION PLANT FEED COMPOSITION

Component—	Volume per cent
Ethane	0.1
Propylene	14.9
Propane	10.3
Isobutane	18.8
Butylene	31.7
N-butane	15.2
Isopentane	3.6
N-pentane	2.5
Amylene	2.9

Insufficient isobutane was available in the refinery; but nearby gasoline plants contracted to supply isobutane of 95 per cent purity for the process. For blending of the finished aviation gasoline, toluene from Cosden's Platformer-Udex and isopentane (95 per cent purity) from gasoline plants was made available.



HORIZONTAL CONTACTORS in HF plant are less expensive than the usual vertical type due largely to savings in structure costs. Fig. 2.

Horizontal Contactors

Another variation from the normal HF plant was installation of horizontal contactors with mixers. These were the first horizontal contactors placed in HF service by Stratford Engineering Co. In this plant are two, operating in parallel, each with its own acid settler. They are manifolded, however, so that they may be operated individually or in series. Power for the mixers, which are mounted in the end, is supplied by direct-drive 50-hp. electric motors. A circulating seal-oil system is used to seal the shaft of the mixer. The oil used is a regular paraffin-type motor oil. Make-up rates with this oil have been fairly low.

Less expensive . . . Horizontal contactors made a less-expensive installation than the usual vertical type primarly because of lower structure costs. The mixer hookup had several features showing advantage over the older type: (1) less horsepower was required to produce mixing, (2) less load on the thrust bearings, (3) scale and sludge were less likely to accumulate around the shaft, (4) angle gears were not necessary, eliminating many of the maintenance problems of the vertical units. Fig. 2 is a diagrammatic sketch of the horizontal contactor.

Defluorinators in Product Stream

A third major change in the plant is location of the defluorinators. In this plant the alumina defluorinators are located following the deisobutanizer. This makes possible defluorination of only product streams, reducing considerably the size of the equipment required. There have been no indications of harmful effects due to placing the defluorinators in the products stream.

Feed preparation . . . This section is made up of the equipment from the old phosphoric acid polymerization plant which was discontinued when the alkylation plant was built. Feed preparation consists of desulfurization and deethanization of the combined olefinic streams from the fluid cat cracker and Dubbs thermal cracker. Desulfurization is accomplished through use of a diethanolamine scrubber for H_2S removal, and a regenerative caustic system for mercaptan removal. Intermediate storage is in service between the feed-preparation section and the alkylation plant proper. This storage consists of a 2,500-bbl.-capacity sphere and ap-

proximately 50,000 bbl. of underground-storage capacity.

Cooling water for the entire plant is supplied from an 8,000-g.p.m. induced-draft cooling tower designed for a 5° F. approach. Contactor effluent temperatures in hot weather range from 80° to 90° F. In cool weather, temperatures run somewhat lower. By being able to operate at temperatures in this range, the use of refrigeration is unnecessary.

Reboiler Heat

Reboiler heat in the plant is supplied from three sources: (1) 50-lb. exhaust steam from the cooling-water turbines, (2) 170-lb. plant steam from the boiler plant, (3) reboiler heating oil from a closed-circuit system using a gas-fired heater. Another unusual feature of the plant involves two reboilers on the deisobutanizer, the top one taking liquid from tray No. 45, and circulating through a reboiler heated by 50-lb. steam; while the additional heat and temperature is applied using the 170-lb. steam in the bottom reboiler.

Fig. 1 is a schematic flow diagram of the plant.

Products . . . These consist of propane, butane, pentanes, light alkylate, and heavy alkylate. Propane is the bottom product from the HF stripper. Product control is maintained through use of the mercury freeze test. To be certain of an acid-free, dry propane stream, the propane is caustic scrubbed and then processed through a dewatering column.

In the original plant flow pattern, butane was the overhead product from the vessel shown on Fig. 1 as the depentanizer. As more amylenes were made available, the original polymerization plant debutanizer was placed in service to make the split between butane and pentane. Control of the butane composition is through use of atmospheric boilaways with daily checks by infrared analysis. Average composition of the butane product stream is less than 1 per cent isobutane and 99 per cent n-butane. The pentanes consist of isopentane and n-pentane, all of which is returned to the motor-fuel pool. The light alkylate serves as base stock for 115/145 performance number aviation gasoline and heavy alkylate is added to motor fuel.

Inspections

Table 2 is a typical inspection report of light alkylate and finished avgas blends.

Low Acid Consumption

A most important and interesting feature is the low acid consumption—even lower than the early estimate of 0.25 lb. per barrel of alkylate. An average over the past 7 months has been 0.19 lb. per barrel of alkylate. This low acid consumption may be attributed to three major factors: (1) high isobutane to olefin ratio (approximately 9 to 1), (2) high acid purity of the circulating acid streams (over 90 per cent) through regeneration, (3) location of the alumina defluorinating towers following the deisobutanizer thereby reducing the amount of fluorides to contact the alumina.

The isobutane recycle stream from the deisobutanizer overhead is checked by the plant operators frequently using the boilaway system. Each day an infrared check is also run to assist in control of the stream.

Results of the past year have been gratifying. The plant was designed to process 2,413 bbl. per stream day of mixed olefin feed to produce 2,064 bbl. per stream day of light alkylate. In capacity tests over 3,000 bbl. per stream day of olefin feed has been charged with no operating difficulties and with the same good product quality. The high quality of the light alkylate has been especially pleasing since propylene and amylene alkylate can be expected to downgrade performance numbers.

Finally, no one has suffered an acid burn in the plant.

TABLE 2—TYPICAL INSPECTION OF LIGHT ALKYLATE AND AVIATION GASOLINE BLENDS

	Light alkylate	Avgas* 115/145
Gravity, °A.P.I.	71.0	70.6
Vapor pressure, Reid, psi.	3.0	6.7
A.S.T.M. dist., °F.:		
I.b.p.	138	104
10 per cent	182	141
20 per cent	192	160
30 per cent	200	176
50 per cent	210	204
70 per cent	218	216
90 per cent	238	236
E.p.	334	314
Recovery, per cent	99	98
Residue, per cent	0.4	0.5
Performance numbers:		
F-3, + 4.6 ml. TEL	119-120	120
F-4, + 4.6 ml. TEL	140-142	145.4

*Avgas blends made up of approximately 77.5 volume per cent light alkylate, 6.0 volume per cent nitration-grade toluene, and 16.5 volume per cent isopentane (95 per cent purity).

Gas Analysis Corrected

The sour-gas analysis in the article, "Here's an Effective Corrosion-Control Program for a Glycol Gas-Dehydration Unit," in June 27, 1955, issue, page 91 should be changed as follows:

H_2S	58 **grains**/100 s.c.f.
Mercaptans	54 **grains**/100 s.c.f.
CO_2	1.36 per cent

Concentrations were inadvertently given as **grams**/100 s.c.f.

BOOK

DESIGNING FOR PEOPLE. By Henry Dreyfuss. Published by Simon & Schuster, Inc., 630 Fifth Avenue, New York 20. 240 pp., $5.

Anyone interested in industrial design, design, or just plain good reading will enjoy reading this resume of things learned by one of America's leading industrial designers, Henry Dreyfuss.

Drawing on his experiences in more than 25 years of designing everything from telephones to aircraft, he has sewn a verbal patchwork quilt of design ideas, anecdotes, opinion, and autobiography. And the finished product is both appealing and functional. Aside from personal enjoyment, the book offers a behind-the-scenes look at the designing of many familiar household products—at the problems encountered, the human elements taken into consideration, and the personal beliefs that entered into Dreyfuss' design decisions.

It tells a fascinating story in simple, lively, conversational language, and it pictures industrial designing in its human relations aspects—as a generous contributor to the welfare and enjoyment of the American people.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.
The index was explained July 7, 1952, (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

INDEX (1946 = 100)

	1948	1950	1952	1953	1954	April 1955
Pumps, compressors, etc.	127.0	138.2	155.6	162.5	166.5	170.4
Electrical machinery	127.6	134.9	152.4	156.4	160.0	160.1
Internal-combustion engines	116.9	126.0	146.5	148.1	150.5	149.6
Instruments	120.0	127.8	146.2	151.8	154.6	158.1
Heat exchangers	130.0	140.0	165.8	174.9	171.7	153.4
Miscellaneous equipment average	*121.1	*126.2	153.3	158.8	160.7	158.3
Materials component	139.3	149.5	164.3	172.4	174.6	171.3
Labor component	128.0	144.0	163.1	174.2	183.3	186.6
Nelson construction index	132.5	146.2	163.6	173.5	179.8	180.5

*Used in computing the Nelson Index until April 1952. These are slightly different than the average of the Miscellaneous Equipment Items shown above.

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Which Type of Instruments Should You Use... Electronic or Pneumatic?

EDITOR'S NOTE: Several refinery processing units are now controlled with all-electronic instrumentation. These control systems are proving highly satisfactory, and a number of processors are weighing pneumatic systems against the all-electronic ones for application in new units.

We've been considering this problem here at the Journal, and we asked the product committee, Foxboro Co., Foxboro, Mass., to help us reach some conclusions.

The committee sent us a statement. It's fair and impartial—it gives advantages and disadvantages of both types. It suggests that application of electronic instruments is probably due for a big increase, but that there will always be a number of uses for pneumatic controls.

In fact, the statement is so good we want to share it with you. Here it is:

BEFORE discussing the relative merits of pneumatic versus electronic instrumentation, certain fundamental facts need to be established.

The latest in electronic instrumentation should only be compared with the latest in pneumatic instrumentation.

A process which is controlled to any degree of excellence with an electronic controller can be controlled equally well with modern pneumatic equipment properly installed.

Where a process is classed as a "fast" one, the dynamics of the control system must be good. It is generally recognized that the pneumatic control valve is the slowest element in the total system, having a response time greater than that of the next slowest element in the control circuit. Thus, any electronic controller which uses a pneumatic valve can gain but little in terms of speed of response.

Pneumatic advantages . . . The reliability of pneumatic transmitters and controllers is extremely high. If provided with clean dry air, they will work indefinitely with no maintenance. We exclude, of course, primary measuring elements such as orifice plates, manometer chambers, diaphragms, Bourdon springs, and control-valve bodies which are subject to process fluids and temperatures and corrosion, etc.

This exclusion is reasonable since all of these factors affect any electronic instruments equally as much.

In many areas total power failures are not uncommon. Where this is the case, all-electronic installations would be dangerous unless standby generating equipment were to be included as a part of the installation.

There are problems to be faced with electronic instrumentation in hazardous locations. Explosionproofing can be accomplished although it increases cost. Checking and testing of electronic instruments in the field in hazardous locations is difficult.

Electronic advantages . . . On the positive side from the standpoint of electronic instrumentation, there are specific advantages. Transmission lags are virtually eliminated, and in some instances this can be particularly important for one of two reasons:

1. Where the distance between point of measurement and placement of controller is over 2,000 ft., the installation of pneumatic instrumentation becomes more difficult and sometimes completely impractical.

2. Where transmission distances are between 200 ft. and 2,000 ft., engineering consideration must be applied to the installation. Choice must be made between the two-pipe system and the four-pipe system of a pneumatic installation.

There is a marked trend toward the use of automatic electric-data logging in the larger processing plants. It is safe to say that some form of automatic logging will be used by the majority of process-plant operators in the future. All of the equipment that has been developed to date to perform this operation is basically electric and electromechanical.

From this it follows that application of automatic logging systems is much more convenient if all the process measurements are made electrically. The specific advantage here is the elimination of pneumatic to electric transducers with consequent increase in overall accuracy and reduction in first cost.

The majority of process control designers prefer to use thermocouples or resistance bulbs for measurement of temperature. Where this is the case, an electronic instrument somewhere in the system is essential. There is definite advantage to keeping the whole system electrical if one must start out electrically.

Other instruments . . . Many instruments for quality control such as pH, conductivity, O.R. potential, capacitance, infrared, etc., must be made electrically. Here again, a good case can be made for the use of an all-electric or electronic system.

There is the inevitable demand for standardization of instruments within a given plant. Thus, there is the strong desire to make all of the instruments either pneumatic or electric. It is possible to make all measurements electrically. But it is difficult, if not impossible, to do so pneumatically. Consequently, we have here a potent desire for all-electric instrumentation.

In summary, it seems that the following statements could be made:

1. The case for all-electronic control is made best for the big user of instruments. Large refineries and chemical plants appear to be the dominant field at least for some years to come.

2. Even where the wish for electric instrumentation is great, there are many problems connected with its use and it would seem that considerable development is required before these problems are satisfactorily worked out.

3. Except in relatively specialized cases, little gain in plant performance can be realized by the change to electronic instrumentation.

4. One of the most potent factors in judging the relative merits of pneumatic and electronic instrumentation is that of cost. Figures can be obtained for the instruments and accessories, but a big factor is cost of installation. It seems to be almost impossible to obtain reliable figures for this phase of the work.

5. More and more electronic instrumentation will be used as time goes by. But it seems safe to say that it will be a long time, indeed, before pneumatic-control instrumentation loses its well-proved place in industrial instrumentation.

At present, except for a few specialized cases, there is little to choose between electronic and pneumatic-control instrumentation from the technical standpoint.

Person to Person

Personal contact often spells the difference between success and failure in any business undertaking. The needs for on-the-spot sales presentations . . . for executive inspection of branch facilities . . . for person-to-person consultation demand the utmost from the sales and service forces and may exceed the physical capabilities of the executive team.

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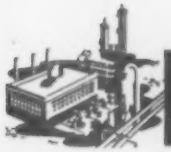


JOB IMPROVEMENT FOR THE PROCESS FOREMAN—15

Controlling Combustion in the Firebox

MAXIMUM firebox temperatures on pipe stills have been established through consideration of process heat requirements and past operating history on safety and maintenance.

The rate of oxidation (burning) of tubes and hangers, and the melting of furnace refractory increases directly with temperature and the amount of excess air (oxygen). The strength of metals decreases as their temperature increases. In order to achieve good fuel economy without excessive furnace maintenance, the ratio of fuel and air should be balanced so as to give the set maximum firebox temperature with the least amount of fuel and excess air.

Thus, maximum firebox temperatures have been selected which are considered practical from the process viewpoint—safe and economical from a maintenance standpoint.

Q. What causes local "hot spots" in furnaces?

A. An even distribution of heat in a furnace is required for high efficiency and avoidance of local overheating. Most of the heat in a furnace is secured by direct radiation from the flame and combustion gases. The remaining heat is secured by radiation from the hot refractor walls and by convection, the transfer of heat by the moving gases.

It is important that the velocity and distribution of gas flow be controlled. The combustion-gas layer nearest to the cold surface transmits heat faster than does the gas in the middle of the chamber, leaving a hot center. When no control of combustion-gas flow exists, the hot portion may sweep out of the furnace without transmitting its heat efficiently. This causes high stack temperature and may result in local hot spots.

Furnace tubes are constantly being heated on the outside and cooled on the inside. If an insulator such as a large coke deposit is developed on the inside surface, then the rate of heat transfer is decreased and hot spots develop on the tubes. Similarly, an insulating liquid film at low charge rates (nonturbulent flow) will result in a general tube-temperature increase.

Courtesy of Phillips Petroleum Co., refining department.

The materials of which furnaces and tubes are built are not designed to continuously withstand the temperatures which develop in hot spots. Therefore, unless these temperatures can be lowered, the result is a rapid material failure.

Q. Which types of burners are used in the petroleum industry?

A. The production of power and the freeing of heat are important operations in almost all industries. The generation of heat in the petroleum industry is as essential to its operation as the combustion of gasoline is to the automobile engine. Without heat, few refinery operations would be possible. Efficient heat generation depends upon good combustion. And good combustion, in turn, depends to a great extent upon well-designed burners and proper burner operation.

Burners may be classified as either oil-burning or gas-burning. In our furnaces, these two types are combined into a single housing, thus making a combination oil and gas burner. (Lube-plant burners are an exception to this; they burn only gas.)

Q. How do oil burners operate?

A. Oil burners atomize the oil, converting it into a fine spray so that the oil droplets are quickly vaporized as they enter the furnace. Atomization enables the combustion process to be completed in a fraction of a second. Although there are several methods of atomizing the oil, steam is used in the refinery because it is readily available and will handle any grade of fuel oil including our high viscosity plant fuel.

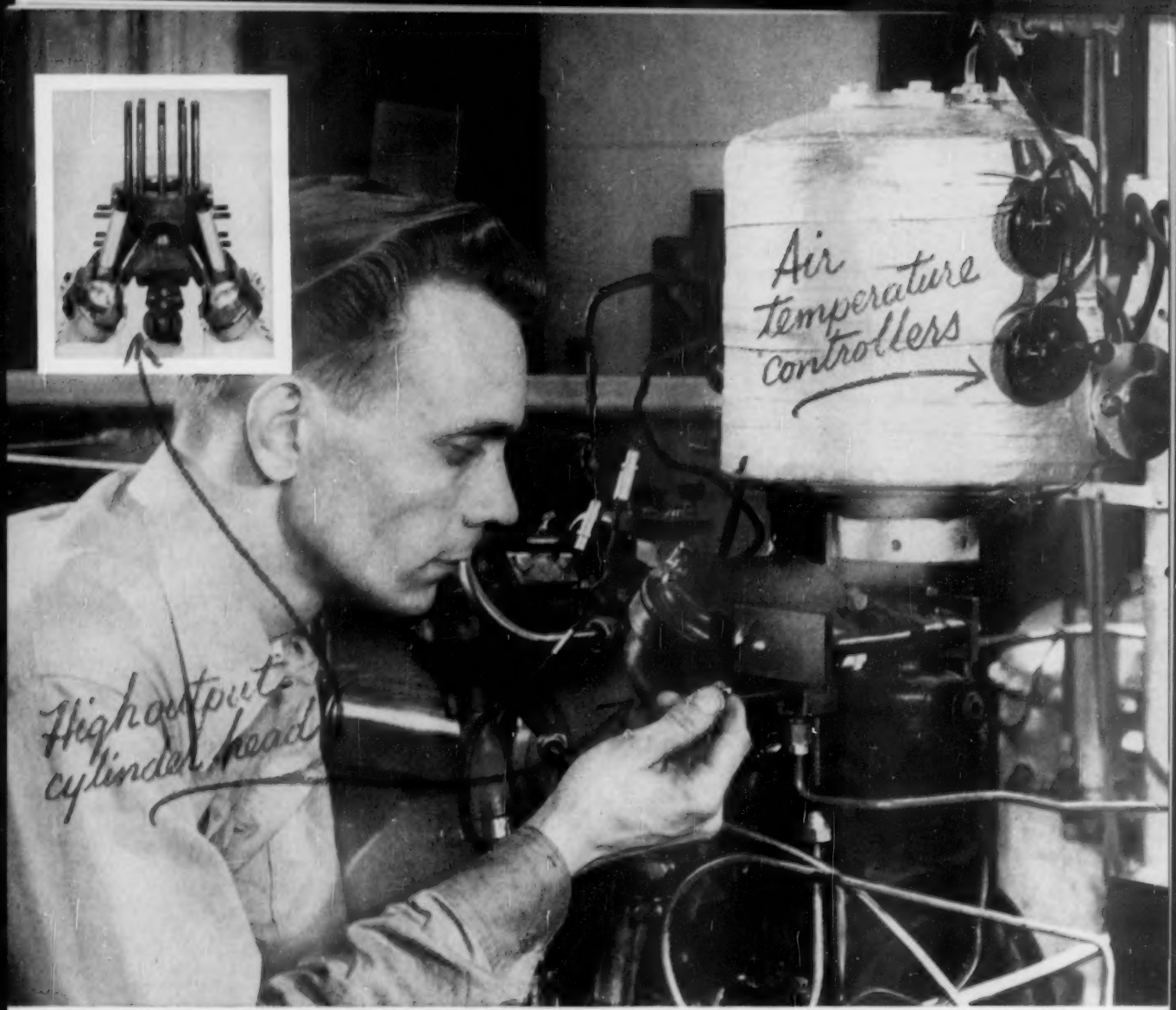
Steam-atomizing burners may be either the outside mixing type or the inside mixing type such as we use. The inside mixing type has the advantage of lower atomizing steam consumption. The steam and oil form a foam in the internal mixing chamber. This foam is directed by the design of the burner tip so that the flame is of proper size and pattern for the firebox.

Viscous fuels should be heated enough to become sufficiently fluid. For very-high-viscosity fuels, the higher the temperature the better the performance. Temperatures should not be used which are above the flash point of the oil, or the flame will sputter. High fuel temperature along with a highly superheated atomizing steam may cause excessive coking at the burner tip.

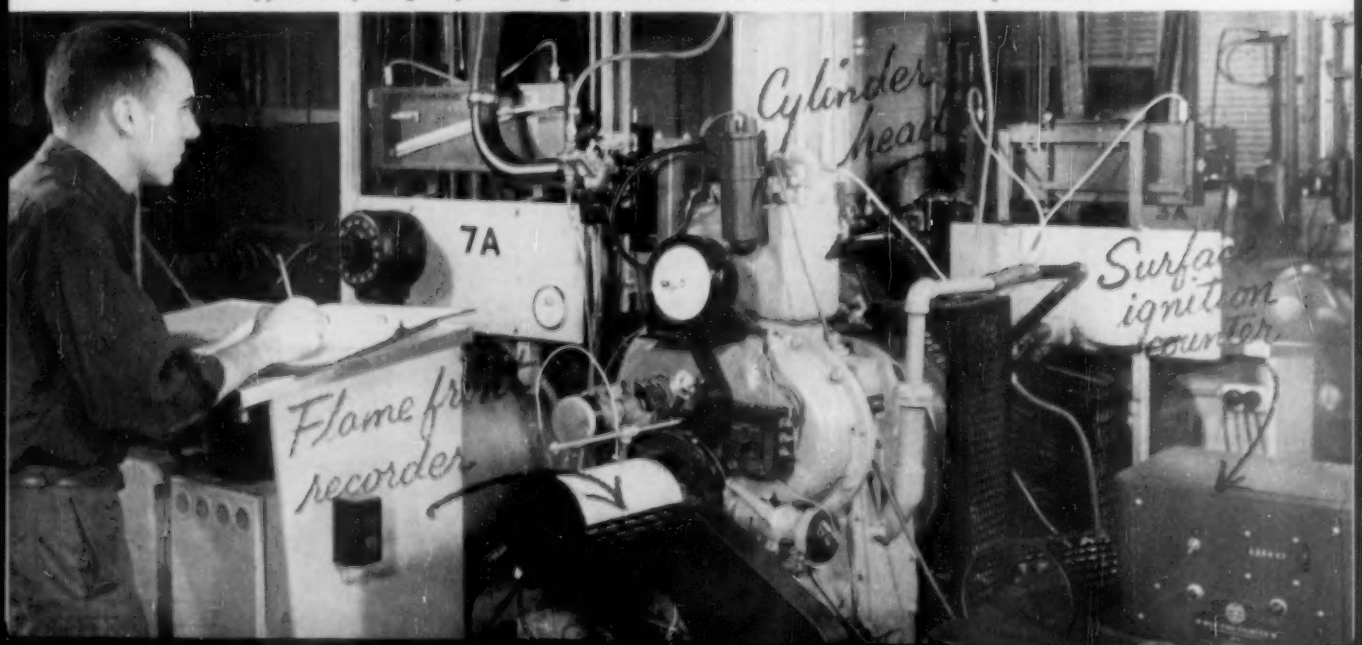
Q. How do gas burners operate? And what is the function of the burner block?

A. Many gas burners are the type which use an inspirator mixer to mix the primary air with the gas before it is delivered to the gas ports. As the gas flows through the mixing chamber, it pulls in a volume of air in proportion to the volume of gas flowing. In this way, the amount of air required for combustion is, to a large extent, automatically regulated for different rates of firing. Air is supplied to other types of gas burners around the flame in the burner block and furnace.

An essential operating part of a burner is the block, the cone-shaped or dish-shaped refractory around the burner. The main purpose of the burner block is to radiate heat to the fuel as it comes into the furnace in order to maintain a stable flame. This allows a wide range on rate of firing of fuel. In order to accomplish this, the burners must be positioned and the holes in the burner tips drilled at such an angle that the block will remain hot. At the same time, excessive flame impingement on the block must be avoided to keep down the maintenance costs.



Experience with high-performance fuels in the famous 17.6 engine helps relate deposit problems to combustion-chamber design.



A typical Ethyl single-cylinder engine instrumented to measure combustion phenomena.

Lower engine octane requirements sought by Ethyl Research

One benefit of this program is the new more effective MOTOR PLUS

How to put the brakes on octane requirement increase has long been of great interest to us at Ethyl Corporation. We maintain a continuous research program on the subject.

Today, through experiments with a variety of modified single-cylinder engines, we are making significant new progress.

Now for the first time it is possible to reproduce in a single-cylinder laboratory engine the performance of a typical cylinder in a modern high-performance automobile engine on the road.

Here's how we went about it. Through the co-operation of car manufacturers, we made special cylinder heads for our single-cylinder test engines. These heads typify those currently used in many passenger cars.

Then to reproduce passenger-car performance, we developed operating schedules in which speed and load are varied automatically so that these chambers will build up the same type of deposits as those developed in a multicylinder engine on the road.

The accurate control and typical passenger-car engine environments of these "new" Ethyl single-cylinder engines now enable us to gather previously unavailable information on the effects on octane requirement increase of fuel composition, oil composition, operating conditions and the effects of new additives. With the help of these engines, we developed Ethyl's new MOTOR PLUS, the improved TEL formula that reduces octane requirement increase on the average from .5 octane number up to 1.3 octane numbers.

Our work in this field continues. We mention it here only as an example of what Ethyl Research is doing to help our customers. If you would like more information on this or any other Ethyl Research project, just call your Ethyl representative.

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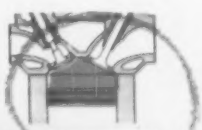
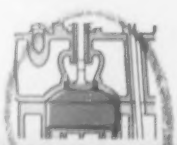
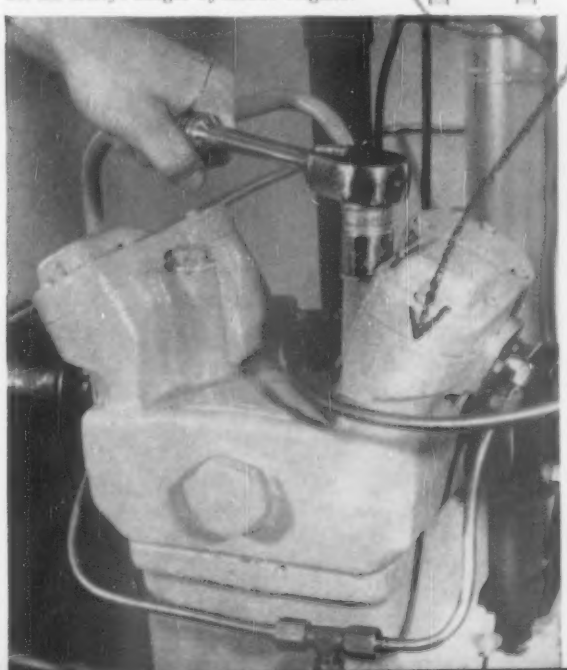
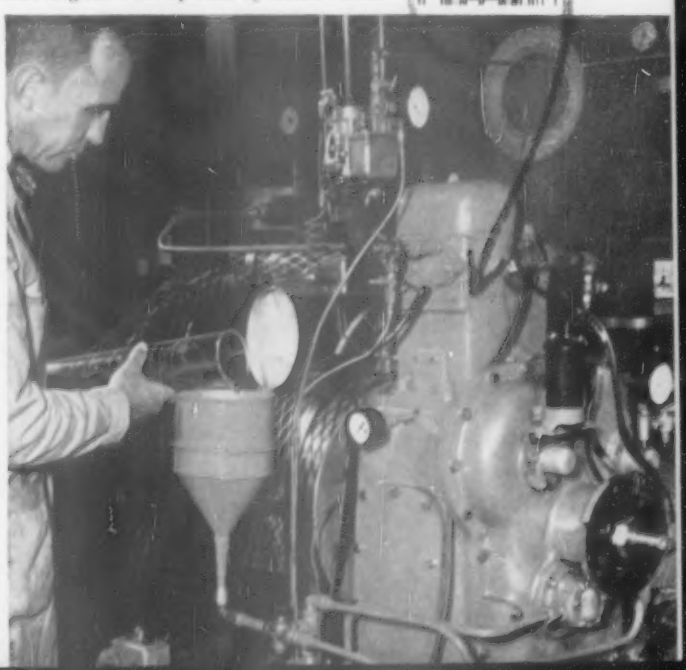


One type combustion chamber used in a popular make of cars is reproduced on an Ethyl single-cylinder engine.



Engine design of another leading car maker is reproduced on a single-cylinder test engine with special cylinder head.





These Crane valves stay tight on soap oils and fatty acids

THE CASE HISTORY—Leakage through valve seats in raw materials supply lines posed a serious problem for Davies-Young Soap Co., Dayton—makers of various type soaps and cleaning fluids. Unwanted materials leaking past metering stations would infiltrate processing vats.

Four different makes of valves were tried before these Crane valves were installed. With all four, results were the same—seat leakage developed quickly; the valves lasted no more than 4 to 8 weeks.

Valve replacement costs were a factor on top of production losses.

The condition was remedied on installation of Crane No. 1670 Ni-Resist cast iron valves in January 1954. Eighteen months later—with no piping maintenance and no shutdowns whatsoever—the Crane valves are still holding tight. And they show no deteriorating effects from the fluids handled.

Crane Ni-Resist gates don't *look* much different from similar valves of other makes. Their difference is in properly designed, accurately finished seating of 18-8 SMo stainless steel—plus the *extra* erosion-corrosion resistance of Ni-Resist bodies and bonnets cast by Crane. Thrifty buyers know these valves have no "equal" for handling many hard-to-hold, mildly corrosive fluids.

You should have the new folder (AD2047) on these valves. Ask your Crane Representative for a copy, or write to Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

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CRANE'S FIRST CENTURY...1855-1955

UNDERGROUND STORAGE—3

How Salt Beds and Domes Were Formed

by N. E. Van Fossan

WASHING of wells was discussed in general in the preceding installment. This topic is concluded here and the formation of salt-bearing deposits is dealt with. The "bar" theory for bedded sections and the upthrust and downbuilding theories for salt domes are taken up. Understanding of how salt deposits were formed is of more than academic interest. Thorough knowledge of formations may cast light on many confusing items that may be encountered in development of underground-storage wells.

U-tube washing . . . A further washing procedure is used in areas where only thin sections of soluble are available for use (Fig. 2). This procedure utilizes two wells drilled in close proximity so that a lateral development of one of them, by procedures previously discussed, will eventually communicate with the bore hole of the second. Thereafter, fresh water will be pumped in one well with returns from the other.

This method may only be used if the capping formation is of an impervious nature and has extremely high structural strength. It can be resorted to in the event that an already existing well were to become dangerous to operate because of stringer failure.

For example, the second well could be drilled and washing procedure carried on through it with returns through the original well to the surface. Product injection and withdrawal would be carried on in reverse direction to the washing schedule.

Salt-Bearing Formations

A thorough knowledge of salt sections will reduce the possibility of costly and most embarrassing blunders that can be made in development of underground storage.

Salt exists in many areas, in all parts of the world, and has been deposited in various geological ages from the Silurian right up to recent times.

The major areas of salt occurrence in the United States are associated with the Permian beds of West Texas, New Mexico, Oklahoma, and Kansas; Silurian beds of the Michigan basin and the Great Lakes or northern Appalachian geosyncline; in the salt domes of the Gulf Coast (of which there are over 140); and in domes of the Paradox formation in southeastern Utah and southwestern Colorado.

Bar theory . . . There are many theories as to the actual method of salt deposition. The most logical involves the evaporative theory. That theory proposes that salt beds are the result of deposition from sea waters in basins connected with the ocean. The theory, commonly called the bar theory, may briefly be stated:

Imagine an inland sea, the entrance to which, from the ocean, is partially closed by a sand bar or barrier. The depth at this entrance is a great deal less than either the bay or ocean. If this sand bar is high enough to allow only enough sea water to enter the bay from the ocean to balance the amount lost in the bay due to surface evaporation, it can readily be imagined that the deposition of some of the salts held in solution would soon take place.

If the bar is composed of sand, it is liable to change, and the salt deposited in the bay will vary according to whether the bar allows more or less water to enter. If more water is allowed to enter from the ocean, the density in the bay becomes less. If it is enough to keep

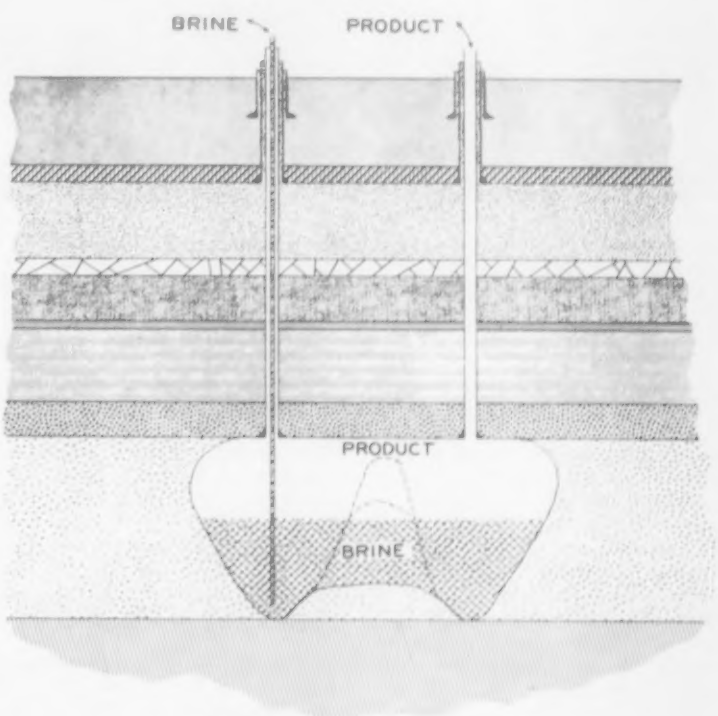


Fig. 2—U-tube washing and storage.

Author is with Texas Natural Gasoline Corp., Tulsa. Paper presented at N.G.A.A., Dallas meeting, April 13-15, 1955.

the sodium chloride in solution but not the calcium sulfate, beds of gypsum (or anhydrite) will be deposited. If, on the other hand, the entrance were closed enough to allow only a very small amount of water to enter, or if the entrance were closed completely, the evaporation in the bay would cause all the more soluble salts to be deposited. Deposition would then stop.

Bedded deposit . . . The constant changing in height of the bar at the entrance then would tend to give a bedded deposit in the bay consisting of layers of limestone, gypsum, salt, etc. This would account for some discrepancies in the natural order of deposition. Further complications and intricacies can be associated with many other factors. For example, permanent closure of the entrance is evidenced in the Permian basin of West Texas.

Here various sections of the inland sea at one time were completely closed off, with the progression of the previously explained evaporate processes continuing to the South and West. Following permanent closure, later carrying of terrestrial sediments by flood (or wind) is seen in the deep red bed formations and intermingling of red bed in the northern reaches of the Permian basin.

Core carefully . . . All this should lend credence to the fact that coring procedures should be elaborate and complete in the original investigation of any area, prior to full-scale utilization of that area for underground storage.

Great variations can occur between beds of different areas, or even within a bed itself, in purity, thickness, percentage insoluble, stringer configuration, etc.

Salt Domes

Salt domes are generally associated with a very deep overburden covering bedded salt sections. The deep burial of the Permian salts in the Gulf Coast area is due to subsidence of the Continental Shelf and the subsequent extreme deposition of sedimentary materials from the interior.

These conditions result in a peculiar situation. Salt, at specific gravity of 2.2 and essentially not lending itself to changes in specific gravity due to pressure, has sedimentary overburden materials deposited above it which are compressible. As a matter of fact, at 10,000 ft. the specific gravity of the sediments will probably be 2.4 versus the 2.2 salt lying under them.

Salt, due to its nature, will exist in a plastic state under the pressures (and resulting temperatures) existing at their depth, and will tend to flow upward due to its relative buoyancy.

Upthrust theory . . . This has its basic premise in the above discussion of variations in specific gravity due to submergence. Due to some accident of nature, an elevation of the salt mass occurred at a certain point and some surface triggering agent (the development of a deep canyon due to a rapidly flowing stream) came into being over that point. As a consequence of these two very opportune circumstances, the hydrostatic head over the salt bubble was reduced to a point that it flowed plastically toward the surface. This flow continued through the geological ages as long as there remained salt in the mother body to feed it. And when this salt mass was exhausted, movement stopped.

"Mushrooms" . . . A byline of this theory brings a fact to light that is of more than academic interest to the underground-storage developer. Many salt domes have an overhanging "mushroom" type of salt protrusion. These overhangs occur, naturally, on the skirts of the dome. They are unpredictable as to depth, and if oil exploration has not been intensive enough to thoroughly locate the main mass of the salt dome, attempts should be made to develop storage chambers as near the center as possible.

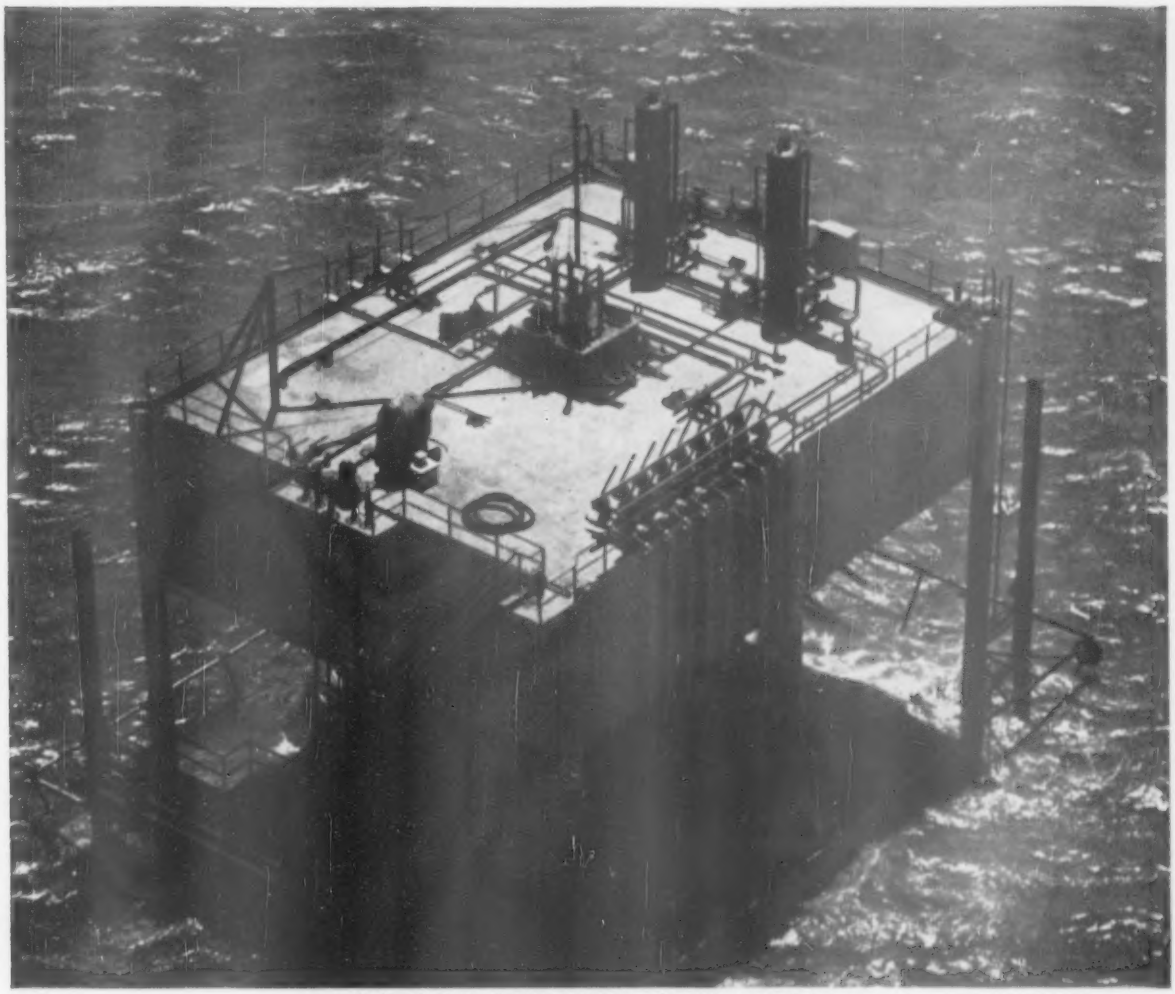
Down building . . . This theory of salt-mass elevation presupposes subsidence of sediments, and the mother body of salt as well, around a peculiar protrusion in the salt bed. This eventually will lead to a gradual elevation of the salt plug due to its remaining stationary in earth space. This theory denies that the buoyance effect due to differences in specific gravity could be of such magnitude as to cause the elevation. But it does admit that plastic flow of the mother body of the salt mass takes place to feed the greater and greater development of the salt finger.

Salt fingers . . . Regardless of theories, gigantic fingers of salt have come into existence in the various coastal areas of the world. These intrusive masses are sometimes more than 1½ miles in diameter and over 20,000 ft. deep. The salt finger retains the characteristic of the mother bed with various layers of the soluble and insoluble material now being in a vertical position on the skirts of the salt mass and continuing across the top in complicated folds. Stringer configuration is not of the magnitude associated with the salt beds of West Texas.

The major laminar characteristic of the salt domes thus far investigated has been variation in the solubility of materials deposited, rather than the deposit of completely foreign material, such as red bed and shales.

Both thin anhydrite stringer systems and disseminated anhydrite sands frequently occur (insolubles at times being up to 10 and 15 per cent by volume of the salt mass). The fact that the salt mass is intrusive in its very nature has led to various and sundry complications. Cap rocks resting on the salt plug are distorted, crushed, faulted, filled with solution channel and inclusions of evaporites, all of which lead to extremely complicated drilling conditions.

Drilling difficulties . . . The cap, in descending order, is composed of calcite, gypsum-anhydrite and a very massive anhydrite base. This formation rests directly on top of the salt plug. At times a false cap exists due to the calcification of the gumbos and clays immediately above the cap. Since the top of the cap is structurally domed, it can be seen that the very upper reaches of the cap will be badly shattered due to tensional breaks and that the lower reaches of the calcite will be badly shattered and crushed due to compressive breaks. Also that, any ground waters circulating over the cap or down through the cap itself would, through this badly shattered section, carry away all soluble materials. Almost invariably, a bad loss of circulation zone is associated with the very upper reaches of the calcite cap. So an extremely cautious approach to the cap itself must be maintained in order that loss of circulation zones will not be penetrated while the drilling muds are heavily laden with cuttings. At the top of the salt, unconsolidated anhydrite sands are sometimes encountered and major cavernous conditions often exist.



A Bethlehem-built Tank Battery Barge on location at an off-shore site.

Bethlehem's Submersible Oil Storage Tank Battery Barge

FOR THE MOST ECONOMICAL AND EFFICIENT INTERIM STORAGE OF CRUDE IN SHALLOW WATER OR MARSHLAND

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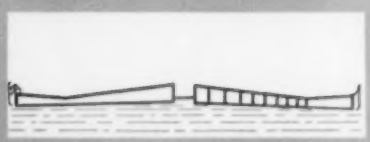

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Separate Penalties for High Sulfur and Sourness

In your answer of January 3, 1955, you show a separate cost of operation for "sourness" as well as a cost for "sulfur content." We thought sulfur meant sourness.—G.F.P.N.

Although technologists that are truly experienced in the petroleum industry agree that the term "sourness" has a specific meaning.[1,2] general technologists and reporters still fail to distinguish between "sour" oils and those that simply contain sulfur. Crude oils are classified as sour if they contain appreciable amounts of dissolved hydrogen sulfide[1] and an amount of 0.05 cu. ft. per 100 gal. of crude oil is considered as significant and dangerous by most operators.

Sourness is important from the standpoint of cost because such oils are dangerous (poisonous and they may cause fires) and because corrosion occurs in field equipments, crude-storage tanks, gathering lines or pipelines, and in the first or topping distillation operations in refineries.[2] The effect of other sulfur compounds than hydrogen sulfide does not become of major importance until after the crude oil has been topped in a refinery whereupon corrosion and a contamination of products occurs.[3,5-7]

Laboratory methods of determining the amount of "sulfide" liberation from high-sulfur (not necessarily sour) crude oils are available.[4] Penalties for sourness alone,[8,9] (that is, dissolved hydrogen sulfide) and for other sulfur compounds that are present (that is, high-sulfur crude oil[10,11]) have been evaluated.

The industry has a clear picture of oils that are classified as sour. At least 170 fields have been named specifically[12,13] as well as the oils from several general regions, and the hydrogen sulfide contents of a few oils have been published.[13] West Texas crude oils are always considered as sour and many of the oils from the Middle East, Kansas, Wyoming, New Mexico, and Arkansas are sour.

The magnitude of the refining costs due to sulfur and due to sourness may be judged from Table 1.

References

(All by W. L. Nelson, Questions on Technology, The Oil and Gas Journal)

1. "What Are Sour Crude Oils? p. 375, July 28, 1952.
2. "What Are Sour Crude Oils? p. 103, Aug. 4, 1952.
3. "High-Sulfur Crude Oils—Potential Hydrogen Sulfur Liberation," p. 309, Sept. 29, 1952.
4. "Determining the Hydrogen Sulfide Content of Crude Oils," p. 145, Oct. 27, 1952.
5. "Sulfur Content of Cracked Products 1, West Texas . . .," p. 171, Nov. 10, 1952.
6. "Sulfur Content of Cracked Products 2, Thermal Cracking," p. 137, Nov. 24, 1952.
7. "Sulfur Content of Cracked Products 3, Catalytic Cracking," p. 129, Dec. 8, 1952.
8. "Penalty for 'Sourness' in a Crude Oil," p. 403, Jan. 26, 1953.
9. "Sour Crudes Require Special Handling," p. 142, June 8, 1953.
10. "Cost of Refining High-Sulfur Crude Oils," p. 150, Aug. 16, 1954.
11. "Penalty for High-Sulfur Crude Oils," p. 90, Nov. 29, 1954.
12. "Sour Crude Oil Fields," p. 145, May 4, 1953.
13. "Sour Crude Oils," p. 131, Apr. 6, 1953.

TABLE 1—APPROXIMATE REFINING COSTS DUE DIRECTLY TO HIGH SULFUR AND TO SOURNESS (EXCLUDING THE TEL REQUIRED FOR GASOLINES)
(Cents per barrel)

Per cent sulfur in crude oil	Costs due to high sulfur: Low gravity or unstable oils‡	Average	High gravity or stable oils*	Costs due to sourness: Stabilized in fields†	Average	Low gravity or unstable oils‡
0.2				0.5	1.5	2.5
0.5	4.5	3.0	1.5	1.0	2.5	4.0
0.75	6.5	4.5	2.5	1.5	2.5	5.0
1.00	8.5	5.5	4.0	2.0	3.0	5.5
1.25	10.0	7.0	5.0			
1.50	12.0	8.5	6.0	2.5	3.5	6.5
1.75	13.5	9.5	7.0			
2.00	14.5	11.0	8.5	3.0	4.0	6.5
2.25	16.0	12.5	9.0			
2.50	17.5	13.5	10.0	3.5	4.5	7.0
2.75	18.5	14.5	11.0			
3.00	20.0	16.0	12.0	3.5	4.5	7.0
3.50	22.5	18.0	13.5	4.0	5.0	7.5
4.00	24.5	19.5	15.0			
4.50	26.0	21.0	15.5			
5.00	28.0	22.0	16.0	4.5	5.5	7.5

*Crude oils of Mississippi and the Middle East tend toward this extreme. †Most Middle East oils are stabilized for the removal of hydrogen sulfide before shipment. ‡West Texas, Wyoming, and Kansas oils tend to be in this group.

Wax Points of Crudes

In your "How to Handle Viscous Crude Oils," November 15, 1954, you mention that the steeper viscosity of United States oils were caused by wax precipitation. At what temperatures do the oils freeze?—S.W.M.

Very complete information is available in the hundreds of U. S. Bureau of Mines analyses of crude oils (Inf. Circ. 7470, Hughes & Blade, June 1948, is an index of analyses) but these have not been plotted to obtain averages. However, Green, Hall, and Luttrell, "Suspended Material Carried in Crude-Oil Streams," Transportation Symposium, A.P.I. meeting, November 8, 1948, Chicago, state the following:

	°F.
West Texas-New Mexico mixtures	60
East Texas	77
North Oklahoma	55
South Oklahoma	45
Kansas	55

The average pour points of Venezuelan crude oils as a function of gravity are:

A.P.I.	°F.
10	70
12	40
14	17
16	0
18	—13
20	—22
22	—28
24	—30
26	—28
28	—14
*32	19
*34	26
*36	56
*38	72
40	84
42	88
44	80
46	66
48	46
50	22
55	—20

*Oficina, Leona, Guara, and Guico oils have pour points 40° to 60° F. lower.

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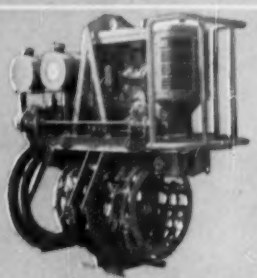
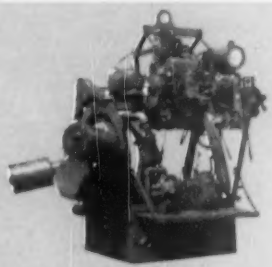
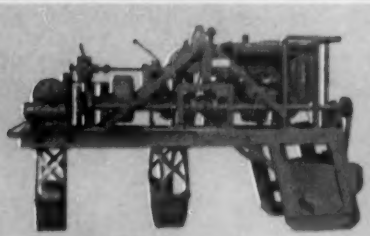


Cleaning and Priming Machines



Coating and Wrapping Machines



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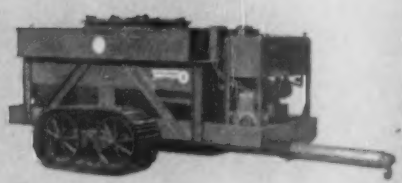

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Planned retirement for tired pump units

Planned retirement of older engine-pump units in crude-oil gathering service will avoid costly maintenance and troublesome shutdowns. Money saved will help pay for replacement unit.

by Robert H. King

IT'S easy to see the need for replacing an engine-pump unit that's obviously on its last leg. But by that time much money has probably been wasted on maintenance. Yes, wasted. For the money spent in keeping the older unit operating "for just a few more years" could have been used to help pay for a new unit. This article points out the need for **planned retirement** of older field units based on a close analysis of costs—operating, overhaul, and intangible.

Engine replacement before costs of operation start to rise sharply will save dollars to pay for a new unit. If spent for maintenance, these dollars will be gone forever.

Typical examples . . . Three common examples of operating costs for 25-hp. engines, 15 to 25 years old, are shown in Table 1. One engine is in good condition, one fair, and one in poor but operating condition. These costs are compared with those of a replacement of latest design and manufacture. The advantages of design and material improvements in recent years are shown clearly.

The more rapid increase in cost of operation and maintenance of an old engine as its condition deteriorates is reflected in Item 1. This may be even sharper when a particular engine becomes obsolete. Then the costs of parts is affected by the limited demand for them.

Higher cost from more extensive overhaul needs and shorter life between overhauls shows up in Item 2. Older units are overhauled at 8,000 hours or less while 25,000 hours is considered practical for the latest engines. Therefore, cost saving widens abruptly. Comparison of total cost (Items 1 and 2) shows annual savings of $110, $200, and $375 (Item 3) accomplished by replacement.

Fuel costs are not included in this table but are becoming more important in many gathering systems. Further savings may be gained by using the more efficient, newer engines.

Intangible savings . . . Provision for other costs of a less specific nature is made in Item 4 of Table 1 (intangible or indirect savings). This amount may vary widely in any one situation or year. To consider it objectively, let us review a breakdown you have experienced recently. If we assign costs to the work caused by the breakdown, an amount will develop that helps to visualize the allowance provided here.

Total annual saving indicated in Table 1 includes these intangible amounts. Variations occurring in any year create a problem when estimating savings of this type. But if we plan retirement to avoid such costs, they must be considered. And remember that money so spent cannot be recovered. If saved by replacement, it again is helping to pay the cost of that replacement.

The cost of replacing the unit (shown in Item 6), is an estimate intended to include both cost of the new engine and any provision for loss in salvage

TABLE 1—COMMON EXAMPLES OF ENGINE OPERATING COSTS—ENGINE-PUMP UNIT IN VARIOUS CONDITIONS—APPROXIMATELY 25 HP. SIZE

Condition of old engine				New replacement unit
Average	Fair	Poor	Item of cost—	
$135	$150	$175	1. Annual cost-operating and maintenance expense Lubrication Operating supplies Repair and spare parts Service labor	$125
125	200	350	2. Annual cost of overhaul Major service and overhauling plus cost of parts replaced or renewed. (Based on overhaul at 8,000 hours for old units, 25,000 hours for new unit)	$25
$260	$350	$525	Total annual operating, maintenance, and overhaul costs	$150
$110	$200	$375	3. Direct annual savings in operating and maintenance expense resulting from replacement. These expense reductions result from lower cost of operating new unit in top condition and elimination of costly maintenance of old engine in poor condition.	
100	150	250	4. Intangible or indirect savings Those real savings not directly identified with cost of operating the engine, such as: (a) Lost time due to engine failure; (b) excessive supervisory and clerical cost to obtain parts, handle overhaul, etc; (c) overtime due to breakdown or other emergency; (d) general cost of interruptions to entire system. For any one interruption or maintenance problem, the actual case history will demonstrate these costs clearly. For example, we are assuming an increase in the amount wasted according to the condition of the engine.	
$210	$350	$625	5. Total annual savings.	
			6. Approximate cost of replacement unit An installed cost of $3,000 is assumed, based on a 25-hp., skid-mounted, direct-connected, engine pump unit with intake and discharge piping intact. For the purpose of this study, it is assumed that salvage value of the present engine is the same as book value and there is no loss from the retirement.	$3,000
14½ yr.	8-9/10 yr.	4-4/5 yr.	7. Time required to recover cost of replacement unit in savings over operation of engines in various conditions.	

Author is consultant cost and methods analyst, Tulsa.

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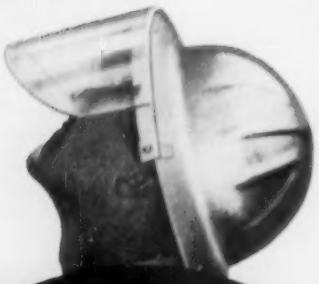

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of the old engine. If a loss at the time the old engine is retired does occur, you will want to consider its value.

Payout period of the replacement cost is shown in Item 7. However, we must examine this situation closely. The whole principle of planning for profitable retirement is at stake here.

For example, savings indicated when the older engine is in salvage condition are $210 each year, and if cost of the replacement is $3,000, more than 14 years are required for payout.

Here dividends are paid by predicting reasonably the time when the condition of an engine will deteriorate more rapidly. Consider the difference in straight-line savings in the following two cases:

1. Assuming no further deterioration in the engine in average condition,

5 year savings at $210 per year, totaling	$1,050

2. But if we assume progressive deterioration over the 5-year period, we have,

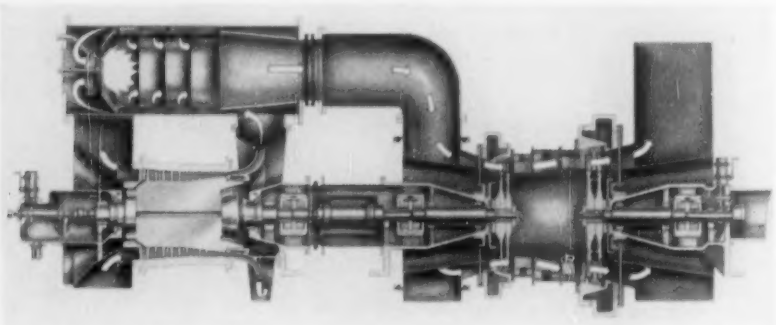
1 year saving at $210	$ 210
3 year saving at $350	1,050
1 year saving at $625	625
Total for 5 years	$1,885

Deferring the cost of replacement, when a 14-year payout does not seem practical, may be wise. However, would you defer the change if you could already see recovery of the replacement in 7 years? Two additional years at $625 each will be $3,035 when added to the $1,885 shown here in 5 years of progressive deterioration.

Funds available for capital expenditure must be considered. However, savings can be gained that will go a long way toward paying the cost of the new engine, before fast dramatic payouts become apparent. These savings will contribute to reducing cost of pumping in a gathering system.

Acknowledgment

The author wishes to thank A. C. Smith, Mid-Continent Pipe Line Co., for guidance in preparation of this article.



What pipeliners should know about this

New 10,000-hp. gas turbine

WITH the trend toward larger single units in pipeline compressor stations, this big new gas turbine may find wide acceptance. The 10,000-hp. machine was designed as driver for a mobile power-generating unit. But it also has features which are attractive for pipeline use. Designer and builder of the turbine is Clark Brothers Co., one of the Dresser Industries.

When used for mobile power generation, the turbine and a 7,500-kw. synchronous a.c. generator, direct-driven, are mounted in an 85-ft. railway car. So mounted, the unit may be moved at passenger-train speed to any area in need of emergency power. Less than 24 hours are needed to put the plant in operation once it is on location. Cost of the complete mobile plant is about $1,000,000.

How about pipeline use? . . . Factors which make the driver a candidate for pipeline use are low-temperature operation, high efficiency without regeneration, ease of maintenance, and ability to burn gas or liquid fuel or a mixture of the two.

The turbine is a simple cycle, dual-shaft machine with a single-chamber combustor. It is rated 10,000 hp. at

80° F. and 1,000-ft. elevation. Both the high and low-pressure turbines have two stages. The high-pressure turbine drives a 13-stage axial-flow compressor at about 5,000 r.p.m. The other turbine is direct-connected to the load. For power generation its speed is pneumatically governed at 3,600 r.p.m. Thermal efficiency without regeneration is about 18 per cent.

Cooling . . . The air-intake system is designed to keep all exposed surfaces, including the combustor, at temperatures below 200° F. Arrows on the cutaway drawing show how this is done. Air from the compressor at left flows through a narrow annulus around the combustor. Some goes to the end of the chamber and mixes with fuel for ignition, and the rest enters the chamber through small slots. The hot gas then flows through the two stages of both high and low-temperature turbines.

The arrangement of the air ducts acts to both preheat the intake air and allow the cooling of the outside of the combustor. Cooling air from the compressor is also piped directly to the housing of the first turbine and to the blade roots of the turbine wheels. This type cooling keeps all parts at a minimum temperature, reducing thermal stress and alignment problems.

Fuels . . . Either gas, diesel oil, residual fuel, or a combination of these fuels may be fired. With either gas or diesel oil, inlet temperature to the first turbine under full load is 1,350° F. With residual fuel, this temperature must be limited to 1,150° F. and output lowered by about 40 per cent. Reason for the lower operating temperature is to prevent corrosive attack on the blades and blade fouling from ash deposit.

Maintenance . . . Easy access to turbine wheels and compressor rotor and stator is a big feature of the machine. The housing between high and low-pressure turbines can be removed easily. This exposes both outside wheels of the two turbines for blade inspection and maintenance.

The axial compressor, built as a horizontal split-shell type, is also easy to work on. With the top half of the shell removed, all rotor blades are available. The stator blades on the lower half of the shell can be removed without lifting the rotor. They are built on quarter-circle rings which slide out of the shell.

Fuel nozzles are arranged so that any one may be shut off and removed for cleaning or replacement while the turbine is operating.

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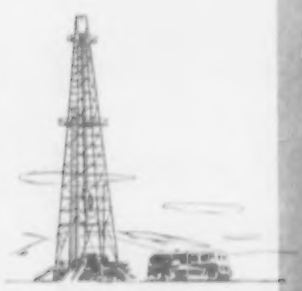

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Drilling Contractors

Delta Gulf Drilling Co., Tyler, Tex., has contracted for another deep test Aluminum Co. of America is undertaking in the Section 28 area of St. Martin Parish, South Louisiana. The new test, 1 Sylvania Bauas Cutree, will be the third for the operating company in the area. Location, in 9-10s-7e, is 2 miles south of production on Section 28 dome.

Rolo Oil Co., Shreveport, is starting a 3,000-ft. Wilcox test for Pickering Lumber Co., of Kansas City, on the latter's fee lands in southern Sabine Parish, West-Central Louisiana. Location is 2 miles east of Toro, in 32-4n-11w.

Nicklos Drilling Co., Houston, is to drill for Amerada Petroleum Corp. at a wildcat location a mile north of Fordoche field, in southwestern Pointe Coupee Parish, 30 miles northwest of Baton Rouge, southern Louisiana. Location is at 1 Martin, in 19-5s-9e. Drilling is set for 10,500 ft.

Sunnyland Contracting Co., Rayne, La., has a rig working for Serio-Punches Oil Co., of Natchez, Miss., at a wildcat location 3 miles north of Fort Adams, in Wilkinson County, southwestern Mississippi. Location of the test, 2 Josephine Best Estate, is in 27-2n-5w. It is a Wilcox test with possible depth of 7,500 ft.

El Dorado Pipe & Supply Co., El Dorado, Ark., is contractor on a 3,700-ft. Travis Peak test J. S. Beebe, trustee, of El Dorado, and Creslenn Oil Co., of Urbana, are starting in the Golden area, 1¾ miles southwest of South Hibank field, in Union County, Arkansas. Location is at 1 Russell, in 10-19s-14w.

H. F. Hatcher & Son, Smackover, Ark., will drill a 4,000-ft. Paleozoic test in Lincoln County, southeastern Arkansas. It is a contract job for Gregg Oil Co., of Gladewater, Tex. Location at 1 Gamble, in 34-8n-8e, is 8 miles northwest of Starr City, and about 20 miles southeast of Pine Bluff. It is about 55 miles from nearest production.

Jett Drilling Co., Inc., Shreveport, is contractor and joint operator with Anthony J. Tamborello, of Houston, at a new wildcat operation 13¼ miles west of Black Hawk, in southern Concordia Parish, eastern Louisiana. The test, 1 Jackson & Lee, in 9-2n-8e, is scheduled to go to 9,100 ft. to explore the Wilcox. It is 2 miles northwest of production in Black Hawk field.

Jett Drilling Co., Inc., Shreveport, is scheduled for a 10,200-ft. Paluxy test to be drilled for Texas Eastern Transmission Corp. in the Compton Lake area, Madison Parish, northeastern Louisiana. Location, at 1 Adams, in 84-15n-13e, is 1½ miles southwest of Coleman, and 8 miles southeast of Tallulah.

Riggs Drilling Co., Shreveport, will drill J. C. Mayfield's projected 5,000-

On the floor of a large rotary rig Big Chief Drilling Co., Oklahoma City, has been operating for Phillips Petroleum Co. in the Oklahoma City area. Back row, left to right: Joe Ford, driller; Elmer Pondley, crewman; William Payne, tool pusher; and Joe Young, Mission Manufacturing Co. Front row: John Underwood (left) and Bill Hance, crewman. (Mission photo.)

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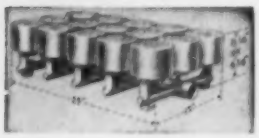

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Major companies using INFERNO "Blue Flame" Low Pressure Gas Burners report terrific reductions in fuel costs. In many cases, the savings actually pay for the INFERNO "Blue Flame" Low Pressure Gas Burners. Operate on any gas pressure from four ounces up. Write for Bulletin No. 30.

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ft. Travis Peak test on the east flank of Bennevue field, in Bossier Parish, northwestern Louisiana. Nearest production, from the Tokio and Pettit zones, is about ¾ mile distant. The new test is at 2 Birele, in 24-19n-11w.

Sunnyland Contracting Co., Rayne, La., has contracted for a 5,800-ft. Wilcox test to be drilled about 1½ miles northeast of Milestone Forks field, in Concordia Parish, eastern Louisiana. Operators are Gauthier & Heard, of Natchez, and W. L. Billups, of Greenwood, Miss. Location is at 1 Turner Unit, in 12-8n-10e.

Fortenberry Drilling Co., Natchez, Miss., will drill a 6,900-ft. Paluxy test about ½ mile east of Killens Ferry field, on the Franklin-Tensas parish line, in eastern Louisiana. Location at 1-C Ayer Timber, in 20-14n-10e, is on the Tensas Parish line, about 15 miles east of Winsboro.

Edwards & Bissett Drilling Co., Houston, has a new contract job under way in the Juanita area, of Beauregard Parish, Louisiana Gulf Coast. It is an 8,050-ft. Yegua test for Houston Oil Co. of Texas at 1 Gunter et al, in 14-5s-11w, and about ¾ mile west of production.

Brewster-Bartle Drilling Co., Houston, will drill for Skelly Oil Co. at a new location, 1 Merrit, in South Bayou Mallet field, in Acadia Parish, Coastal Louisiana. Location is in 36-7s-1e.

Frio Drilling Co., San Antonio, has a rig working for Carrl Oil Co. and George H. Coates at a wildcat location 4½ miles southeast of Driscoll, in Nueces County, lower Texas coastal area. The test is carried as 2 Weiner. Location is in Section 143, George H. Paul Subdivision of the Driscoll Ranch. Permitted depth is 6,000 ft.

Delta Gulf Drilling Co., Tyler, Tex., has contracted for another well California Co. will drill in the North China area, Jefferson Davis Parish, southern Louisiana. The new operation, 1 Rush et al, is 3,850 ft. northwest of the operator's gas-condensate discovery well. Location is in 26-7s-4w. Permit calls for 9,000 ft.

Kerr-McGee Oil Industries, Inc., Oklahoma City, is drilling for California Co. at a wildcat location in the Black Hollow area, western Weld County, northeastern Colorado. The operation, in 30-8n-66w, is carried as 1 Norman Brown. Black Hollow field produces from the Permian horizon. It is the only Permian production in the Denver-Julesburg basin.

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Showcase

OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

New Liner Increases Life By Use of Ductile Iron

A new liner, Tuffy Nuff, made of ductile iron, has the strength and ductility of steel and the low cost of iron.

Tuffy Nuff liners are tough enough to increase liner life two to five times and at no premium price. Ductile iron, the cast iron that has ductility, possesses the toughness of steel and the wearing qualities of cast iron. Ductile iron achieves its properties from a process which causes the graphite particles to become solid spheres rather than broad flakes which break up the continuity of the ordinary cast-iron metal matrix.

Tuffy Nuff liners offer these advantages: economy, toughness, long life, hardness, abrasion and corrosion-resistance, and lubricating effect. **For more information write or call: D+B Division, Emsco Manufacturing Co. P. O. Box 2098, Terminal Annex, Los Angeles 54, Calif.**

•

Floculating Reagent Accelerates Settling

A new group of synthetic polymers have the ability to agglomerate finely divided solids in liquid suspensions, with resultant improvement in settling and filtration rates.

Aerofloc reagents are large complex molecules which, when added to aqueous suspensions, bond together the individual fine-solid particles into flocs. These flocs settle more rapidly than the unconsolidated particles leaving a clarified supernatant suitable for reuse or for discarding without creating a pollution problem. Where suspended solids are removed by filtration, Aerofloc reagents have improved filtration rates as much as 150 per cent on various types of materials. **For more information write or call: Mineral Dressing Department, American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.**

•

Casing-Patch Method Reduces Round Trips

A positive and foolproof casing-patch process provides a means by which leaks may be permanently repaired with just two trips of the working string.

The process enables the operator to locate the leak, cut off the casing below it, repair the leak with the H-E Type W thin-wall casing patch, and test the job in just two round trips. Conventional methods require four or five round trips to do the same job.

The H-E Type W thin-wall casing patch is designed to catch and pack off casings from 4½ to 7 in. **For more information write or call: Houston Engineers, Inc., P. O. Box 567, Houston, Tex.**

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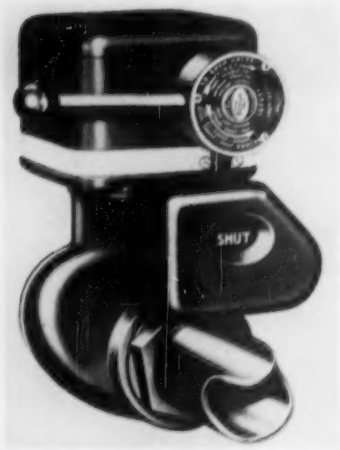
..... OF NEW EQUIPMENT



Manual-Reset Valves Made For Flame-Failure Systems

Fireye Series-81G manual-reset valves are especially designed for use with Fireye flame-failure safeguard systems for use in shutting off the flow of fuels in oil and gas burners in cases of faulty operation. The system shuts off the valves in the event of: flame failure, fan or pump failure, loss of electrical power, or faulty operation of pressure or temperature-limit switches, time-delay relays, or other interlocks in the burner-control circuit.

The positive, leakproof closing action of these valves provides maximum protection against burner-explosion hazards. Their foolproof manual-reset mechanism prevents reopening unless the electric holding coil is energized. Full-area port and straight-through body design offer higher capacities with lower pressure drops. Extra-power holding coils, glass-insulated for longer life, are provided, together with a corrosionproofed latching assembly. These new features plus heavy-duty construction assure trouble-free operation with minimum attention on the most rugged industrial service.

The new valves are U.L. and F.M. approved. They are available in sizes from 1 to 4 in. for use with manufactured, natural or mixed, and L.P. gas, and in 1 and 1¼-in. sizes for use with preheated Nos. 5 or 6 oil.

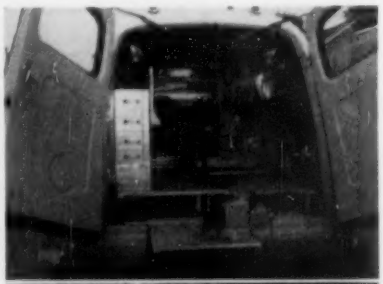
For more information write or call: Combustion Control Division, Electronics Corp. of America, 718 Beacon Street, Boston 15, Mass.

●

Camco Provides Panel-Type Wire-Line Service Unit

A new wire-line truck is designed and assembled to provide, in compact space, every necessary feature for efficient and accurate wire-line operation. The new unit is mounted on a Ford panel truck. With a hydraulic reel, an electronic weight indicator, and a sound device, the truck has many features never before utilized in this work.

The unit is powered by two Denison hydraulic motors which are rated at 21.8 hp. Fed by a third motor which operates from a power take-off from the truck transmission, the motors are connected in a manner that provides full torque when both motors are in use, or half the torque and twice the speed when only one motor is operating. Designed for long and hard usage, the unit will come out of the hole from



12,000 ft. at a speed of 1,200 ft. per minute, and will deliver a line pull at the surface of 1,600 lb. at maximum torque.

One of the improvements of this unit is an electronic weight indicator which measures the load line in pounds. In connection with this, a sonic device reflects the down-hole noise to a speaker in the truck. The built-in testing device, complete with nitrogen bottle, tests valves at the well as they are brought to the surface. To provide maximum maneuverability, all equipment is made of aluminum where feasible.

The aluminum line reel accommodates 15,000 ft. of two sizes of line, i.e., .092-diameter line for high-pressure operations and aircraft cable for strength and safety. **For more information write or call: Camco, Inc., P. O. Box 9334, Central Park Station, Houston 11, Tex.**

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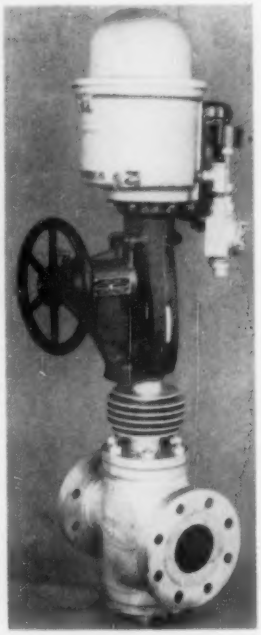

Electro-Hydraulic Control Valve Operator Announced

A new self-contained electrohydraulic control valve operator eliminates all need for air supply and compressor systems now used to operate controllers for process variables such as pressure, temperature, and flow.

Designed to position conventional slip-stem control valves (illustrated), the new control-valve operator uses hydraulic force developed by a self-contained pumping unit supplied by 115 or 230-volt electrical power. Incompressibility of the hydraulic fluid permits positive positioning of the valve against greatly varying stem thrust, thus overcoming valve flutter and accomplishing more accurate control. Positioning accuracy is established by a self-contained feedback system.

Signals are unaffected by ordinary ambient conditions and transmission-line variations. Under proper conditions, the transmitter can be separated by as much as 30 miles from controls and control-valve operator. Control signals received by the control-valve operator may include proportioning, reset, and rate actions for the purpose

STRATAFRAC

DOWELL treatment fractures and acidizes in one operation for extra production boost

In a Stratafrac® treatment, advance-design Dowell equipment is used to pump acid-kerosene material into the pay zone to fracture and acidize in a single operation. Hydraulic pressure, suspended sand and acid all combine in an extra-powerful Dowell treatment designed to enlarge the well's drainage area . . . to increase permeability . . . to boost oil or gas production for you.

Yet down-time is short with Stratafrac. Liquid materials arrive at the well already mixed. Treatment is fast with minimum shut-in afterwards, and no gel breaker needed.

Stratafrac's unusual flexibility makes it effective in almost all types of formations. To match well conditions, Dowell engineers can vary acid and sand content, or add silicate control and clay dissolving agents. This double-action Dowell treatment has brought outstanding, *sustained* production increases to wells in almost every area.

For service, or for more information, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Department H-11.

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of controlling, ratioing, and programming. **For more information write or call: Manning, Maxwell & Moore, Inc., Industrial Controls Division, Stratford, Conn.**

•

E-Z Casing Swab Has Controlled Fluid Lift

The new E-Z casing swab is companion to the E-Z tubing swab. The new swab has the first casing swab rubber with controlled fluid lift.

The casing swab makes swabbing jobs safer by eliminating line breakage due to overloading, lessening slack-line danger, and enabling inexperienced crews to handle swabbing jobs easily because of the simplicity of the operation.

By controlling the amount of fluid lift (with built-in overload relief action) it eliminates buying overload-relief valves. It falls easily through tight spots, falls faster, eliminates junk in casing, and pulls easier.

The new swab lowers swabbing costs by practically eliminating the extra expense resulting from stock swabs, and by reducing swab inventories because one E-Z swab rubber serves all swabbing needs. It lowers accessory costs by eliminating the need for swivels and reducing the need for jars. And its long-lasting, specially-compounded rubbers give much longer life. **For more information write or call: Mission Manufacturing Co., P. O. Box 4209, Houston, Tex.**

•

Offshore Landing Features Safety for Men, Equipment

A new personnel landing for offshore platforms is designed for the safe transference of personnel between structure and vessel. It will also prevent damage to the vessel and the structure during this transference.

The landing consists of a landing net anchored to the deck of the structure and stretched between two hawsers. These hawsers, in turn, are secured to an overhead structural member, then through rings in the ends of spring assemblies and back horizontally to be secured again to the structure just above the waterline.

In the plane of each hawser are two spring assemblies located in the area of vessel contact. They consist of pipe struts pinned at a common point to permit necessary vertical movement. One assembly is horizontal and approximately 9 ft. above water, while the other extends downward to within approximately 2 ft. of the water. On the free end of each strut is a spring housed in a pipe cylinder, on the extreme end of which is a large ring. The ring is free to move. The over-all length of these assemblies is such as to extend beyond any fixed obstruction behind the netting.

The two pairs of spring assemblies are braced together for stability. Additional hawser is tied between rings in the same horizontal plane to provide protection for bow landings.

A fixed landing and stairway is provided behind the netting, and a caged ladder is provided on the outside of the netting. This arrangement provides three alternates for reaching the deck of the structure or abandoning it. Men may use the stairway by stepping through an opening in the netting, climbing the netting itself, or using the protected ladderway.

The breasting force of vessels would be absorbed by flexure in the hawsers, compression of the springs, movement of the assemblies and rings, and the matting of rope on the rings. **For more information write or call: W. Horace Williams Co., Inc., 833 Howard Avenue, New Orleans 12, La.**

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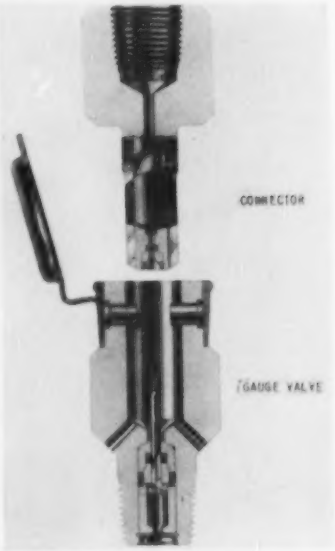

Gage Valve and Connector Eliminate Permanent Gages

The gage valve and connector eliminates the need, and therefore the expense, of permanently installed christmas tree gages. It permits the use of a single-master gage and therefore results in accurate and consistent-pressure readings.

The unit is made of stainless steel and is tested to 30,000-lb. psi. The mechanical design of the gage valve and connector is illustrated in the cross-section view herewith. The upper element with J-slot is attached by threaded connection to the master gage. The lower element with built-in valve is attached to the top cap or blanking plug. The lower element is installed permanently in the same manner as a pressure gage and valve are installed on a tree. A hinged cover is provided on the lower element.

To obtain a pressure reading on the well, the master gage with upper element attached is inserted in the lower element and rotated one-third turn. This slight rotation engages the J-slot with the lower element and opens the valve, exposing the gage to well pressure. As the J-slot is disengaged by rotation in the opposite direction, well pressure automatically closes the valve in the lower element. Any pressure trapped in the body of the lower element is relieved through ports provided in the body. On wells having

pressures of less than 500 lb., a spring-actuated valve is provided. **For more information write or call: Thornhill-Craver Co., P. O. Box 1184, Houston, Tex.**

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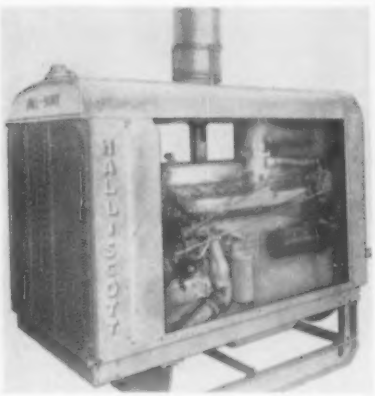

Hall-Scott Engine Features Low Weight-Power Ratio

Model 590, designed for a variety of industrial-engine applications, develops more than 200 hp. and weighs less than 1,300 lb., a power-weight ratio of less than 6 lb. per horsepower. Competitively priced, it is suitable for replacements as well as original equipment installations in oil fields, light plants, and many other services.

The new engines are available for gasoline, L.P.G., or natural fuels. The Model 590 is of square design, 5-in. bore, and 5-in. stroke. It has oversize bearings, oversize oil and water-pump capacity, a full-flow lubricating filter, and cast-aluminum-alloy pistons.

One important development is the head design with overhead cam shaft and rocker arms actuating overhead valves. This design permits placing valves on both sides of the center line of the head so that larger valves with ample water jacketing can be used.

Another feature is the hemispherical combustion chamber. This chamber creates controlled and sustained power thrust, resulting in substantially increased power and economy. **For more information write or call: West-Marquis, Inc., 785 Market St., Phone, Garfield 1-1716, San Francisco, Calif.**

●

Epikote-Base Coating Made To Resist Acids, Alkalis

Group 37 Epikote-based finish has exceptional protective properties. Group 37 produces an extremely hard and tough mar-resistant surface that is highly resistant to acids and alkalis. It also has exceptional resistance to petroleum, benzole, and lubricating and fuel oils. For this reason, it is excellently suited for use in chemical plants as well as on road, rail, and marine tankers. The hardness of Group 37 is such that on many jobs it is an excellent alternative to vitreous enamel. It is, in fact, a finish that can be used for a remarkably wide range of purposes.

Group 37 can be applied by brush or spray on wood, metal, or concrete. Under normal conditions it is touch dry in 4-6 hours, although this may be accelerated with hot-air blowers or radiant-heat lamps on large objects. Group 37 is available as a transparent clear finish or as a primer and enamel in a number of shades. **For more information write or call: International Paints, Ltd., Grosvenor Gardens House, London S.W. 1, England.**

●

Kuplex Deactivated Copper Compounds in Gasoline

Kuplex metal deactivator is particularly effective in deactivating copper and copper compounds present in refinery products. Petroleum-industry research shows that copper in gasoline acts as a catalyst for oxidation which increases gum formation. An effective copper deactivator decreases the amount of antioxidant necessary for the prevention of gum formation in gasolines which contain trace copper. In many cases, the use of Kuplex will reduce treating costs and improve product quality.

Kuplex effectively deactivates copper in other hydrocarbons as well as in gasolines. It also is effective in preventing product deterioration due to copper contamination in kerosine, diesel oil, home-heating oil, jet fuel, and turbine oil.

Kuplex prevents the undesirable reactions caused by copper by combining with the metal to form a stable, inactive chelate. **For more information write or call: Tretolite Co., 369 Marshall Avenue, St. Louis 19, Mo.**

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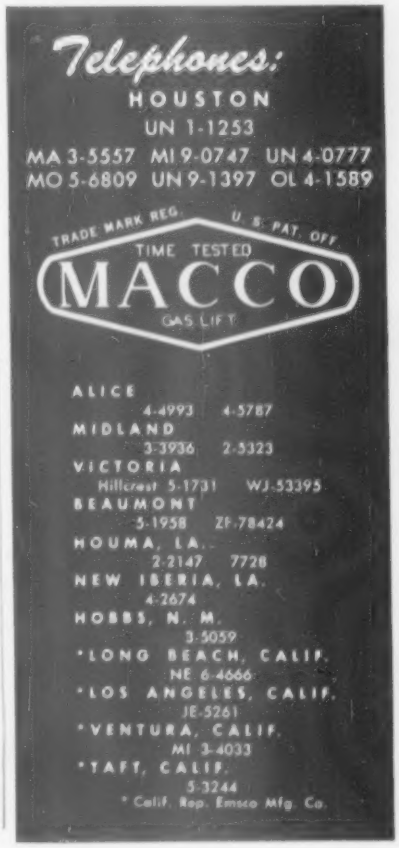

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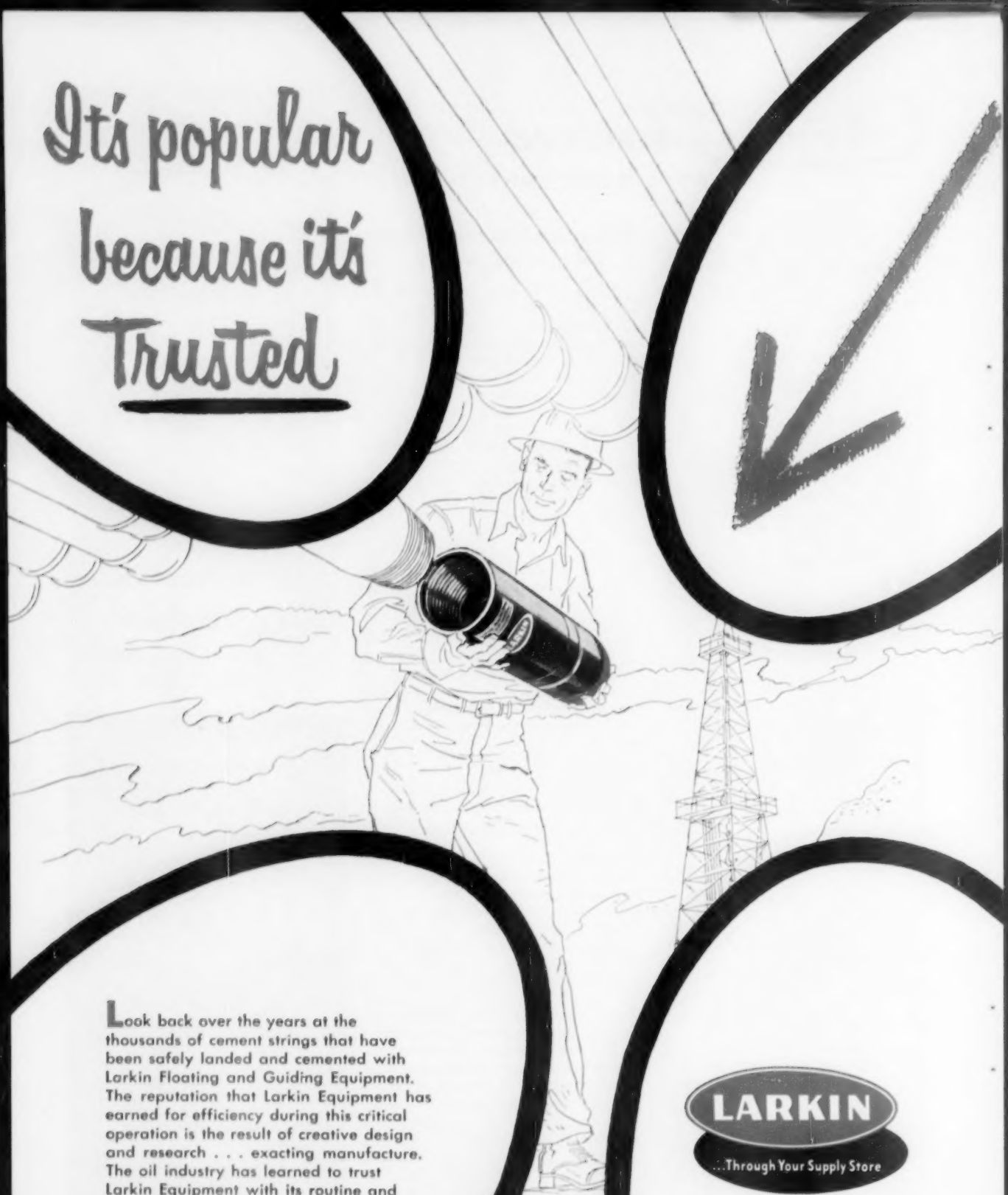

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OIL AND GAS JOURNAL

Showcase

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ExpandZorber. A complete line of flexible pipe connections used to solve vibration and expansion-control problems in industrial and process piping is described in a new catalog, No. EZ-55. The stainless steel, welded-diaphragm-type, packless-expansion joint described is widely used for absorption of vibration, expansion, and contraction in steam, chemical, oil, and gas lines. The catalog describes pressure and temperature ranges of application, lists dimensions and specifications, and illustrates the various types of special-purpose joints available. **For more information write or call: T. R. Finn & Co., Inc., Industrial Division, Hawthorne, N. J.**

●

Oil Filters. Three colorful, eight-page equipment bulletins tell the story on a new line of oil filters. Bulletin 101 describes the full-flow filter. This new unit, designed for in-line installation, offers flow rates of up to 900 g.p.m. at very low pressure drops. The multi-cartridge filter is featured in Bulletin 201. Six different types of cartridge elements can be used interchangeably in this versatile unit. Bulletin 301 covers bulk-type filters. These units provide depth-type filtration and are used in applications where oil must be kept absolutely clean. **For more information write or call: Filtration Division, Houdaille-Hershey of Indiana, Inc., 78 South Avenue, Lebanon, Ind.**

●

Cash Standard Controls. A new four-page bulletin contains photographs of 27 items in the Cash Standard line of automatic valves, regulators, controllers, hydraulic valves, refrigeration back-pressure valves, and complete systems for process and combustion control. A description of recommended applications, construction and operation features and range of sizes is also included: **For more information write or call: A. W. Cash Co., P. O. Box 551, Decatur, Ill.**

●

Proportional Feed Inhibitor Injection System. Instrumentation Data Sheet No. 7.0-6 contains data on operation,

HERE'S THE *New* RUPTURE DISC FOR BS&B SAFETY HEADS...

...ESPECIALLY DESIGNED FOR USE IN LOW PRESSURE APPLICATIONS UNDER SEVERE CORROSIVE CONDITIONS!

For many years the problem of producing a low pressure rupture disc that could withstand prolonged exposure to severe corrosive conditions was a perplexing one. Yet, it was a problem that *had* to be solved, particularly for the Process Industries.

Therefore, it was only natural that BS&B — originator of the Safety Head — should come up with the right answer in the form of a flat type rupture disc whose bursting pressure is controlled by a top metal section, isolated from the corrosive contents of the protected vessel by a sealing membrane of Teflon or Kel-F.

If back pressure is not anticipated, the bottom metal section of the disc is cut open to full relieving capacity (Model 1A). However, if a vacuum support is needed, the bottom metal section is constructed similar to the top section to serve as a vacuum support (Model 1B). Top and bottom sections are spot welded together to give a single compact unit.

Disc Models 1A and 1B are constructed of corrosion-resistant metals such as Inconel, stainless steel, nickel, Hastelloy B and Monel. Either model is available in 2", 3", 4", 6", 8" and 10" sizes. Pressure ratings are from 8 to 100 lbs. Close design tolerances are an inherent feature of this type disc.

If you have a pressure relief problem which you have not been able to solve satisfactorily with the regular pre-bulged type of disc or other types of relief devices, try the new BS&B Model 1A or 1B disc. It fits any standard size BS&B Safety Head flanges you may now have in service. Also available in a complete assembly consisting of inlet and outlet flanges, rupture disc, studs and nuts.

Your BS&B Man will be glad to give you details . . or you may write for descriptive literature and prices.

BS&B Safety Heads

THE "CIRCUIT-BREAKER" OF Pressured Systems

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

BLACK, SIVALLS & BRYSON, INC.
Safety Head Division, Dept. 2-AS
7500 East 12th Street, Kansas City 26, Mo.

accuracy, and general information on instrument components. Schematic diagrams are shown. **For more information write or call: Minneapolis-Honeywell Regulator Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa.**

●

Tri-Clamp Stainless Steel Fittings. A multicolor bulletin, No. 1055, perforated for loose-leaf binding, describes fittings designed for corrosion applications. The fittings consist of a flange-type ferrule, a special precision-molded gasket which fits into the grooved-ferrule lip, and the tri-clamp itself. The clamp is composed of a fabricated spring clamp which grips the ferrule edges, and a simple, bolt-type coupler assembly firmly secured to the clamp ring, always in position for instant assembly or disassembly. **For more information write or call: Tri-Clover Division, Ladish Co., Kenosha, Wis.**

●

Reflin Fiberglass Plastic Pipe is described in a two-color, illustrated folder. Durable, lightweight, easy to handle, and corrosion-resistant, this pipe is suitable for a wide range of applications in the petroleum, chemical, and utility industries. It provides higher allowable pressure, greater resistance to heat and impact loads, and has excellent physical properties at extreme temperatures. The pipe, and a complete line of fittings, is available in diameters up to 12 in. **For more information write or call: L. L. Potomac, Reflin Co., 5730 Kearny Villa Road, San Diego, Calif.**

●

How Zinc Controls Corrosion. This 32-page, illustrated booklet describes the ways zinc lengthens the life of steel products and reduces maintenance costs. Drawings, charts, and photographs together with brief comments presents the corrosion-control characteristics of zinc coatings, zinc pigments, and zinc anodes. A selection of industrial, marine, and building applications of zinc is reviewed. **For more information write or call: American Zinc Institute, Inc., 60 East 42nd Street, New York 17, N. Y.**

●

B & W Scratchers and Centralizers. A new illustrated, perforated bulletin describes latch-on centralizers, latch-on stabilizers, and multiflex, nu-coil, and rotating scratchers. A centralizer selection chart covers all combinations of casing and hole sizes. Instructions for the installation of this equipment are also given. **For more information write or call: B & W Inc., Box 5266, Phone WA-3-6603, Houston 12, Tex., or Box 3751, Phone PL-6-9101, Los Angeles 54, Calif.**

●

Aero Commander-560-A has a 10¾-ft. cabin with an optional seven-place seating capacity. The new GO-480-D1A dry sump Lycoming engines have a rated power of 275 hp. each. A new brochure is fully illustrated and gives specifications chart. **For more information write or call: Aero Design & Engineering Co., Tulakes Airport, P. O. Box 118, Bethany, Okla.**

●

High-Voltage Motor Starters. Folder No. 1062-P shows installations of 2,200-5,000-volt motor starters for hazardous, semihazardous, and outdoor and indoor locations. Starters are designed to cut space requirements and installation time to a minimum. High interrupting-capacity contactors clear fault currents quickly and cleanly. **For more information write or call: Electric Controller & Manufacturing Co., 4500 Lee Road, Cleveland 28, Ohio.**

●

Side-Wall Coring Tools. Complete information is given in a multicolor cata-

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ARCCO CANNON NEVER-DRY PEN
Writes for Months
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log showing life-size pictures of cores taken from all oil-producing areas of the United States. This percussion-type tool fires hollow bullets into the formation by means of an explosive charge, electrically fired by controls at the surface. Thirty samples can be taken at 10,000 ft. in only 2 hours. A coring-device dimensions chart is shown. **For more information write or call: Schlumberger Well Surveying Corp., P. O. Box 2175, Houston, Tex.**

●

Lubricated Plug Valves. Reference Book 39-5, a 28-page catalog, shows straight-way, three-way, four-way, and multiple port-lubricated plug valves for 250-lb. oil-water-gas and 150-lb. steam-working pressure; offers wide choice of metals and sizes in 100 per cent pipe area and venturi types. **For more information write or call: Homestead Valve Manufacturing Co., Coraopolis, Pa.**

●

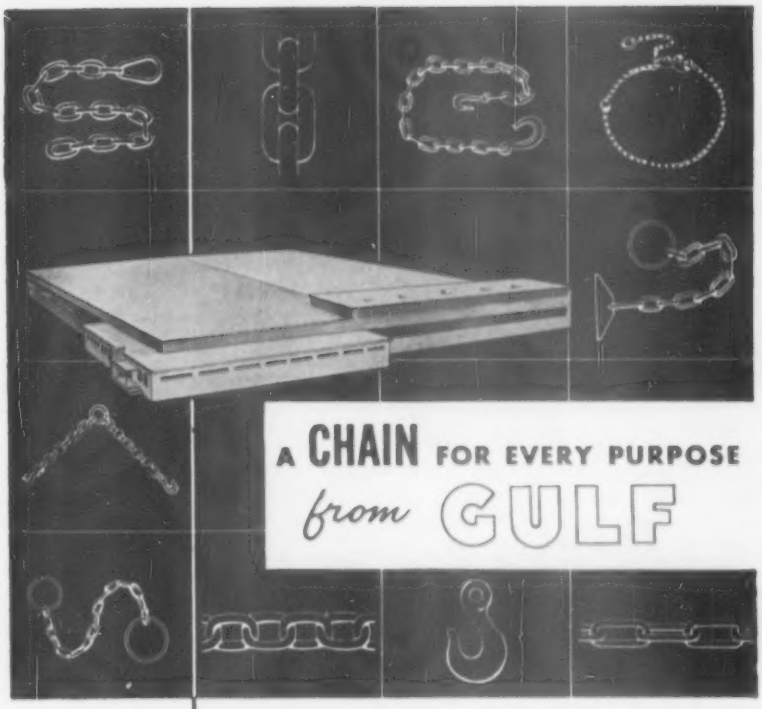
A-P Solenoid Valves. A new six-page, two-color bulletin covers the entire range of A-P solenoid valves. These valves, designed for use with liquids or gases, can be used for stop-and-start operations, mixing and blending, metering or measuring, controlling pressure differential, and for controlling pressure, temperature, and flow. Information on proper selection, features, coil construction, lift ratings, coil frequencies and liquid capacity, and typical applications are listed. **For more information write or call: A-P Controls Corp., 2450 North 32nd Street, Milwaukee, Wis.**

●

Automatic Mixed-Bed Demineralizers. Technical Reprint T-137, Treatment of Makeup Water with Automatic Mixed-Bed Demineralizer, discusses a specific installation at which a completely automatic mixed-bed demineralizer is located. There is a discussion of the factors that led to the choice of this type of equipment, the actual system itself, and the problems of starting up the plant. There is also a section devoted to the operation of the system and the results obtained. **For more information write or call: Graver Water Conditioning Co., Phone WAtkins 4-2321, 216 West 14th Street, New York 11, N. Y.**

●

Needle Bearings. A comprehensive new catalog conveniently presents design, application, and use data for five types of needle bearings. The illustrated catalog, designated as No. 55, comprises an engineering short course on bearings and is organized for practical use in



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properly selecting needle bearings by type, size, and suitability. Page designs, illustrations, indicators, and thumb-guides are keyed to the index and color coded to direct the reader to members of the product family of specific interest. **For more information write or call: The Torrington Co., Torrington, Conn.**

●

The Commander KP Pressure Recorder is a new industrial instrument for the measurement of pressure of water, steam, oil, air, gas, or other fluids. The pressure-measuring elements are Bourdon tubes which give a range from 15 to 3,500 psi. and vacuum down to 30 in. of mercury. A brochure, Publication 370, gives special features, illustrations, and specifications. **For more information write or call: George Kent, Ltd., 199-201 High Holborn, London W. C. 1, England.**

●

Two-Stage 125-lb. Compressor. These sliding-vane-type compressors for shop air, gas handling, drilling, and many other applications are described in new Bulletin No. 16B8244. Built in various sizes to deliver air at pressures from 60 to 125-lb. gage, the compressors are designed for low maintenance and constant efficiency. **For more information write or call: Allis-Chalmers Manufacturing Co., 1059 S. 70th Street, Milwaukee, Wis.**

●

Laminated - Steel Flexpin Couplings. Where to use and how to specify flexible couplings to eliminate accidental shaft misalignments and load shocks is the subject of Bulletin No. 53. The bulletin provides data for proper specification of the recommended coupling size for a range of motor drives from ½ hp. at 600 r.p.m. to 250 hp. at 3,600 r.p.m. Dimensional drawings plus a table show characteristics of the 21 sizes of flexible couplings available. **For more information write or call, Smith & Serrell, Inc., 200 Washington St., Newark, N. J.**

●

Cleveland Speed Variator. Description, ratings, dimensions, and other engineering data on all models of this variator are contained in a new bulletin, No. K-200. This line will meet most of the needs of engineers and designers of equipment such as metal-working machinery, experimental equipment of many types, conveyors, and processing equipment. **For more information write or call: Cleveland Worm & Gear Co., 3249 East 80th Street, Cleveland 4, Ohio.**

●

Standard-Steam Generators. A new four-page brochure covers pre-engineered, standardized steam generators offered in nine sizes, with capacities of from 50,000 to 150,000 lb. per hour, and presents schematic and cutaway drawings of the units and design features. The units offer a selection of maximum working pressures to 1,500 psi. without superheat, or to 1,100 psi. with superheat; steam temperatures, saturated to 950 F.; oil or gas firing; choice of type and location of accessories. **For more information write or call: Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.**

●

Compar Plastic Products. A new four-page bulletin describes compar-plastic hose and hose assemblies, sheets, and molded products. The plastic, compar, is a modified polyvinyl-alcohol resin processed into a tough, strong, and flexible elastomeric material which is unaffected by water-insoluble liquids, including those which attack solvent-resistant synthetic-rubber formulations. **For more information write or call: Resistoflex Corporation, 39 Plansoen Street, Belleville, N. J.**

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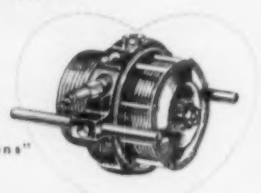

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EQUIPMENT MEN . . . in the News

Halliburton Makes Changes In District Supervision

New manager of Halliburton Oil Well Cementing Co.'s Lubbock division is William L. (Bill) Hughes, Halliburton president L. B. Meaders announces.

The new division manager was employed by Halliburton in 1938. He has worked in Halliburton's cementing, dump bailer, bulk cement, acid, and credit departments.

Halliburton's Lubbock division includes part of Texas and all operations in New Mexico.

Joe W. Maly, Halliburton's assistant division manager at Oklahoma City, is transferring to Denver to serve in the same capacity of Halliburton's Rocky Mountain division. He will assist Obie L. Stalcup, Rocky Mountain division manager.

Replacing Maly at Oklahoma City is George S. Battles, former customer-contact representative for Halliburton's Oklahoma division.

Welex Names Foster Sales Engineer at Wichita Falls

Herman D. Foster, Jr., has been named to the position of sales engineer for the Welex Jet Service, Wichita Falls district, the Fort Worth oil-well service company has announced. Foster, who has had 5 years of experience in oil-field service work, has been with Welex for nearly 3 years.

Jones & Laughlin Office Opened at New Orleans

The Jones & Laughlin Supply Division has established a new district sales office in the Hibernia Bank Building, in New Orleans, La.

The announcement was officially released by Rainey Elliott, president of the firm headquartered in Tulsa.

The recently organized sales office of Jones & Laughlin Supply Division, which supplies tubular goods, wire rope, pumping units, and a complete line of oil country rotary and production equipment to oil-well drillers and oil producers, occupies 480 sq. ft. of office space on the ninth floor.

Clarence E. Rogers, the division's Louisiana Gulf Coast district sales manager, will maintain office headquarters here with Bill Wood, salesman for the New Orleans area.

Schlumberger Opens Station At Harrisburg, Ill.

Schlumberger Well Surveying Corp. has opened a new location at Harrisburg, Ill., to take care of increased activity in the southern end of the Illinois basin due to the recent development in Eldorado field.

Willis P. Baker is in charge of the new station. Joseph A. McGuire is engineer. Both logging and gun-perforating services will be available from Harrisburg.

Baker has been employed by Schlumberger since 1947.

Cooper-Bessemer Announces Pacific Coast Changes

James W. Reed, vice president of Cooper-Bessemer, has been appointed Pacific Coast manager in charge of the company's offices in Los Angeles, San Francisco, and Seattle. John Rogers, who occupied this position for the past 15 years, has been appointed special representative and consultant. These changes have been announced by Stanley E. Johnson, vice president and director of sales for Cooper-Bessemer Corp, Mount Vernon, Ohio.

Reed, a vice president of the company since 1947, has been New York

JAMES W. REED

JOHN ROGERS

district manager of compressor and stationary-engine sales since 1940. Joining the company in 1922, he opened the company's first Pacific Coast office in Los Angeles in 1925, remaining there until being transferred to New York.

Rogers came to Cooper-Bessemer in 1940, bringing with him 25 years of experience in the field of compressors and power engines.

Schmidt Appointed Western Co. General Sales Manager

C. N. SCHMIDT

Charles N. Schmidt has been appointed general sales manager of Western Co., according to an announcement by H. E. Chiles, president. His headquarters will be at the concern's general office in Midland, Tex. For the past 7 years Schmidt has held an executive position in the sales department of the United States Steel Corp. in Pittsburgh. Prior to that he was associated with American Steel & Wire Co. of Cleveland as manager of its advertising division.

During this period, Schmidt traveled extensively through the oil fields in the interest of wire-rope sales. Later, he was in charge of United States Steel's exhibit at the Tulsa Oil Show.

Nuber Promoted to Field Sales Manager By Bristol

ERNEST NUBER

Ernest Nuber has been appointed to general field-sales manager for The Bristol Co., according to an announcement by Harry E. Beane, vice president in charge of sales. Nuber joined the Bristol sales-engineering organization in 1929. He was made Pacific Coast manager in 1934 and was later brought to the home office at Waterbury to become export manager. In 1948 he was promoted to the position of manager of the company's application-engineering department and has held the position of sales manager since the first of 1954.

Lane-Wells Opens Branch In Willows, Calif.

To serve the increasing needs of northern California fields created by mounting activity in the Glenn County area, the Lane-Wells Co. has opened a new branch in Willows, it was announced by William J. Taylor, Bakersfield district superintendent.

The new branch is equipped to pro-

vide perforating service and well-logging service on the usual 24-hour-a-day basis. It is under the direction of Carl J. Niebuhr, Jr., veteran in oil-field service. William V. Stratton comes with Niebuhr to staff the new branch.

Kent Joins S&R Tool As Sales Engineer

William D. Kent was recently appointed sales engineer of S&R Tool & Supply Co. of Houston. In 1946 he joined Salt Dome Oil Corp. as a petroleum engineer. In 1950 he went with Ingalls Shipbuilding Corp. as district sales engineer. Before joining S&R Kent was consulting engineer and manufacturer's agent for pneumatic and hydraulic-equipment applications. He will represent S&R in sales and service on all types design and fabrication of oil country and industrial equipment.

Edwards Is Harnischfeger's Vice President, Diesel Division

F. C. EDWARDS

Frank C. Edwards was elected vice president of the diesel division of Harnischfeger Corp., Milwaukee, at a meeting of the company's board of directors, according to an announcement made by Walter Harnischfeger, president of the corporation.

Edwards, who has held a number of positions with the company, was appointed general manager of the P & H diesel division in Crystal Lake, Ill., in September 1953. He has served his entire business career with Harnischfeger, having started in the company's Milwaukee shops in 1925.

Kuhn Made Sales Manager for Hills-McCanna Products

Charles Kuhn has been appointed sales manager of the products division of Hills-McCanna Co., Chicago, it has been announced by C. A. Howe, president.

Kuhn will be responsible for sales of Hills-McCanna Saunders patent diaphragm valves, chemical-proportioning pumps, and force-feed lubricators.

Kuhn was formerly vice president in charge of sales of the Fansteel Metallurgical Corp.

Friedlander Is Sales Head For Diesel Energy Corp.

R. D. Friedlander has been appointed general sales manager of the Diesel Energy Corp., New York, it has been announced by Maximilian B. Bauer, vice president and chief executive officer.

Friedlander will be in charge of U. S. sales for all products of Kloeckner-Humboldt-Deutz A. G., Cologne, Germany, which are imported by the Diesel Energy Corp. He will also be responsible for the existing distributor and dealer organization.

Friedlander has worked as manager for various machinery and diesel-engine manufacturers in Europe and in the United States.

Oilwell Makes Harris Pawhuska Store Manager

Appointment of James R. Harris as store manager of the new Pawhuska, Okla., store of U. S. Steel's Oil Well Supply Division, has been announced by Mid-Continent area manager Mark Barkhurst.

Harris was employed at the "Oilwell" Ponca City, Okla., store in 1946 as storeman. In 1951 he was appointed field representative at Ponca City and served in that capacity until his present appointment. Prior to his employment with Oilwell, Harris had 4 years' warehousing experience with a major oil company.

At the same time, Barkhurst announced the appointment of Richard L. Pickens as field representative at the new store. Pickens was employed in 1952 as a storeman at Wewoka, Okla. In 1954 he was transferred to Oilwell's Cushing, Okla., store in a similar capacity and served there until his present appointment.

Rohland to Head Oil Field Equipment Sales for Delta

G. W. ROHLAND

The appointment of George W. Rohland, Jr., as oil-field equipment sales manager in the Lafayette, La., area, was announced by Hal S. Phillips, president of Delta Tank Manufacturing Co., Inc. Rohland, a veteran of more than 20 years in the oil industry, served previously as supervisor of drilling, production, and lease development for the Barnsdall and Sunray Oil companies. He began his career as a roustabout in southern oil fields in 1934 and later was engaged in general oil-field contracting and equipment-sales work.

Delta, a wholly owned subsidiary of General Gas Corp. of Baton Rouge, produces oil-gas separators, bulk-handling equipment, and pressure vessels.

Magcobar Announces Sales, Service Promotions

JOHN E. LYONS

George H. Moore, general sales manager for the Magnet Cove Barium Corp., Houston, has announced the following promotions in the Magcobar sales and service department. John E. Lyons has been named sales coordinator, and Arvel C. Smith, former division sales manager with Magcobar's Mid-Continent division in Tulsa, has been named sales administrator.

ARVEL C. SMITH

R. B. HYDE, JR.

R. B. Hyde, Jr., has been named chief engineering consultant on Moore's staff.

JACK G. WALKER

HINCHLIFFE

Jack G. Walker, former export and industrial sales representative, has been appointed export sales manager.

R. E. Hinchliffe, former district manager in Magcobar's Lake Charles district, has been named manager of the company's Fort Worth division.

Franklin Supply Reelects Officers and Directors

At the annual shareholders meeting of Franklin Supply Co., Chicago, held at the company ranch at Granby, Colo., the following officers were reelected directors: Jene Harper, president; Larry Harper, Tulsa, vice president; Roy

Wood, Chicago, vice president; and Leland Strouse, Denver, vice president. William Quan, corporation secretary, was elected a director, and Albert J. Michell was reelected treasurer.

Dowell Shifts Hanson From Wichita to Houston

Maurice E. Hanson has been transferred from Wichita to Houston to act as service supervisor, according to Dowell's general manager A. C. Polk. Prior to his move to Houston, Hanson was area manager at Wichita for 3 years. He joined the company at Great Bend in 1945. Since then he has been successively service engineer, development engineer, district sales engineer, and area manager in the company's Kansas district.

In his new position Hanson will be responsible for the coordination and supervision of Dowell's oil-field services in the Texas Gulf Coast district. The company operates from several places along the Gulf Coast from Mission to Beaumont. Hanson's office will be at the district headquarters in Houston.

Eastham Joins Happy to Head New Houston Office

J. M. EASTHAM

John M. Eastham, Jr., former sales engineer for American Locomotive Co., has joined the Happy Co. to head the firm's newly opened offices in Houston, according to Leo C. King, president of the firm. The home offices and plants of the company, which manufacture and distribute oil-field equipment and accessories, are in Tulsa.

Kneifel Represents Marsh In Pittsburgh Area

Earle L. Kneifel has been appointed sales representative for Marsh Instrument Co. in the Pittsburgh area. He will serve all of southwestern Pennsylvania extending as far east as Juniata County. Before becoming associated with Marsh Instrument Co., Kneifel was employed as an engineer with North American Aviation.

Pittsburgh Adds Three Products to Coatings Group

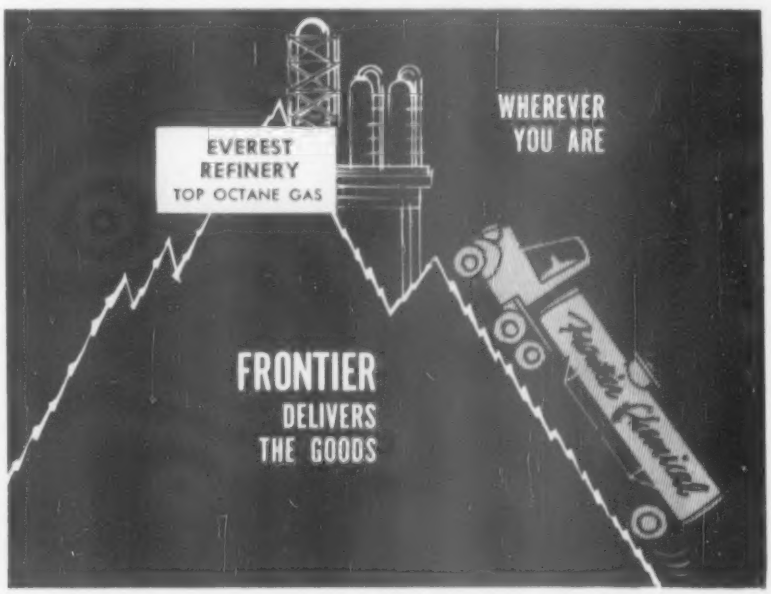
The Pittsburgh Coke & Chemical Co., Pittsburgh, has announced the addition of specialty tars, coal-tar pitch, and creosote to the products manufactured and sold by its protective coatings division. These materials were formerly handled by the company's coal chemicals division.

N. T. Shideler, manager of the protective coatings division, said the move will fully integrate the division's position in the production of Pitt Chem pipeline enamels and coal-tar coatings.

In addition, further emphasis is being placed on Pittsburgh's program of upgrading basic coke-oven-derived materials and of developing new products from these materials.

Shideler said this accelerated technical program will be conducted by the research laboratory for the protective coatings division, utilizing trained personnel with many years of experience in the field of such basic coal-derived materials as pitch, creosote, and other coal-tar products.

The move will also intensify Pittsburgh's quality-control program in the production of protective coatings, and will afford an expanded technical-service program relating to the sale of pitch and creosote.



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You get protection plus for both casing and sidewall when you use Halliburton's S-3 Casing Centralizers. Their more positive centering force assures a better, more uniform cementing job all around, up and down, because of better circulation in the annulus.

Keystone of the outstanding performance record of the S-3 is its rugged strength, proved in thousands of job-tests—tests that proved loss of bowed height in each spring after permanent set was as low as 3.94% in smaller sizes, 8.2% in larger sizes—figures no run-of-the-job type centralizer can match. This built-in strength makes the S-3 do more work per foot . . . you get more positive centering force with fewer units. And because the massive steel springs are lap-welded to end bands, torque remains less than on so-called "free hanging" casing!

For rugged protection of casing without clutching or gripping—even in key seats, tight holes and extreme deviations . . . for more positive centering . . . more uniform cementing . . . specify S-3 Casing Centralizers. Call your local or district office of the Halliburton Oil Well Cementing Company.

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CEMENTING EQUIPMENT

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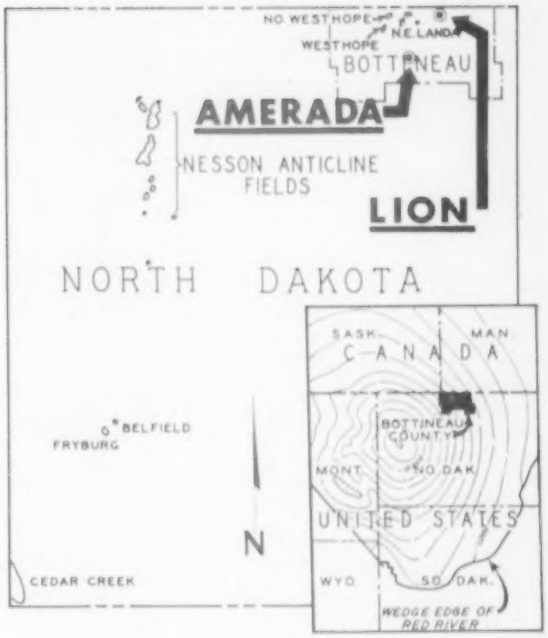
EXPLORATION

East-Side Williston Still Seeks Answer

by Frank J. Gardner



Two east-side wildcats have encouraged Williston basin operators in the search for stratigraphic traps. Insert shows generalized structure of the basin on Red River-Ordovician.

OIL hunters on Williston basin's eastern flank are persistent. For the past 2 years, they've lived in hopes of finding another Roselea or another Virden-Daly south of the Canadian border. Two recent wells have kindled a fire of hope in Bottineau County, North Dakota, but, as has happened before, the fire is mostly smoke. The two wildcats featured on the map have contributed more knowledge than oil in the effort to solve the riddle of east-side oil pooling.

Welcome news . . . Lion Oil Co.'s find, the 1 Skarphol, in Section 33-164n-77w, recovered 2,190 ft. of oil on an early test of the Mississippian-Mission Canyon at 2,972-88 ft., with no water. This was welcome news, for water is the plaguing element in the Bottineau fields. Also, Lion was opening the easternmost area yet discovered in the basin. But the final result was a moderate 100 bbl. per day, cut 30 to 40 per cent with water.

Amerada Petroleum Corp. 1 Beauchamp gave a less encouraging recovery on test, but made news by promising the basin's first Triassic pool. Two tests of the basal Spearfish formation at 3,402-11 ft. yielded flows of 23 and 38 bbl. of oil, both with nearly equal amounts of water. A successful completion in the Spearfish would have given Williston its eighth oil-producing rock system. But recent performance of the well (Section 21-161n-79w) doesn't augur of a real success. In another sense, it **is** a success—it's a stratigraphic confirmation of the real possibility for Triassic pools on Williston's eastern flank.

And a missing key . . . Few Rocky Mountain geologists will condemn Williston's eastern reaches. Every oil-trapping factor in the books is there. But so far, they just haven't found the key to the crypt. They know, though, what they have to look for, and every confirmation of a geologic belief leads closer to the cache.

What are they looking for? Briefly, any one of three types of strat traps. First, erosional wedgeouts. Erosional intervals occur between almost all the rock systems here, and often between the rock series.

Second, porosity traps—facies changes, reefs, or secondary porosity occurrences—all are prime targets. The lensing out of the Dakota and Lakota sands of the Lower Cretaceous are excellent proof that this type trap exists, although these particular sands are water bearing and not real objectives now. But facies changes in the Paleozoics from carbonates to sands (e.g. the Ordovician-Winnipeg sandstone reservoir) are very important targets. Secondary porosity traps in the Mission Canyon and Lodgepole of the lower Mississippian are also top objectives. As for reefs, these are exposed in surface Silurian rocks in Manitoba, and although they're not large, they are porous. Similar subsurface reefs would form excellent reservoirs.

The third strat category includes unconformity traps—within, above, or below the break. And here's where Amerada's test is interesting. The Triassic-Spearfish has a porous sandstone at its base in Bottineau County, capped by impervious shales above. It directly overlies the truncated lower Mississippian oil-bearing beds. Several wells in the county have found saturation in the Spearfish and small amounts of oil have been produced from it, but so far no commercial wells have resulted. The oil has migrated across the Mississippian-Triassic unconformity and has been trapped in the basal Spearfish, normally to be considered the least likely formation to produce. Again, the Triassic, in nearly all the eastern part of Williston, successively overlies (from west to east) the Permian, Pennsylvanian, Mississippian, Devonian, Silurian, and Ordovician systems. Any place, then, where the basal Triassic is a potential reservoir sandstone, it's logical to expect an oil pool **if** this Triassic sand overlies a truncated, oil-bearing older rock, and **if** sufficient structural or porosity trap control exists.

May turn smoke to fire . . . So the finding of oil in eastern Williston is no cinch. It's a matter of time, patience, and close subsurface scrutiny. It's an area of thin sediments, facies change, and rapid truncation, almost devoid of structure. The strat traps are closely associated with unconformities, and are localized by minor structural movement. The target is stratigraphic, the problem is localization, and the solution is obscure. But sufficient subsurface data are accumulating that the problem may be eased, and east-side operators are hopeful that new knowledge will soon lead to new pools.

Encouraging is the recent increase of development potentials in the fields of Bottineau, and a consequent rise of production from 7,800 bbl. daily in December 1954 to 20,000 bbl. in May of this year. Every favorable development lends fuel to the fire that has been kindled at Bottineau. The fire is mostly smoke, but the smoke will brighten into flame.

HERE are the locations of U.S.G.S. field offices, along with the areas and types of oil and gas projects now being conducted by the fuels branch.

Here's a quick, current review of

What U.S.G.S. Does to Help You Find Oil

by Ralph L. Miller

THE U. S. Geological Survey has produced many geologic maps and reports on fundamental research that have been valuable to the oil industry since the Survey's founding 75 years ago.

With the development and general acceptance of the anticlinal theory of oil accumulation, the geologic and structural maps that had been and were being published by the federal and state geological surveys became recognized as basic guides in the search for new oil fields. And the oil industry turned to geology as a fundamental aid in the search for petroleum.

Tremendous impetus to the new profession of petroleum geology was given by the increased need for oil during and after World War I. Before World War II, the research contributions of the U.S.G.S. to the development of the petroleum industry consisted largely of the preparation and publication of accurate geologic and structural maps and comprehensive reports on the geology of areas favorable for the accumulation of oil, including careful and detailed studies of surface stratigraphy and paleontology.

The current program in petroleum geology by the U.S.G.S. began in 1943. It was then that the stimulated demand for oil pointed out the need for more research in petroleum geology by government and industry alike if the desired tempo of new oil-field discoveries was to be increased or even maintained.

Geologic division . . . Most of the U.S.G.S. research in petroleum geology has been and is being done in the geologic division of the Geological Survey, although some research is also done in the conservation division.

Within the geologic division of the Survey, work in the field of petroleum geology is done in the fuels branch, which devotes almost all its efforts to research in the geology and domestic resources of oil and gas, oil shale, and coal. This article, however, is devoted to a description and analysis of the recent and current oil and gas program of the fuels branch alone.

Fuels Branch

The specific objectives of the current program are:

1. To add to the fund of basic scientific knowledge about such general subjects as stratigraphy, sedimentation, geotectonics, and paleogeography, and such specific subjects as the migration and accumulation of oil and gas.

2. To assemble, evaluate, and publish information on thickness, correlation, composition, porosity, permeability, lateral gradation, and structure of sedimentary rocks, with the objective of preparing regional paleogeographic,

The author is with the U. S. Geological Survey, Washington, D.C. This publication is authorized by the director, U. S. Geological Survey.

lithofacies, and tectonic maps of major sedimentary basins.

3. To aid in the systematic geologic mapping of the United States.

4. To supply general information on oil and gas resources and possibilities to the public and to other governmental agencies.

Geological information of immediate economic significance is not released at any stage of an investigation until it can be made available to everyone, either through publication or by a publicly announced availability of open-file reports for inspection. Reports are placed in open files only when the need for such data is so immediate and pressing that any delay incurred by waiting for formal publication is not in the public interest.

It generally is permissible for individuals or companies to reproduce, photostat, or otherwise copy such open-file maps and reports at their own expense.

Recent program of the fuels branch . . . Petroleum investigations have been made in the past 10 years in many parts of the United States. Projects are continuing in almost all the important oil-producing states and in many of the producing or potential oil provinces of the country. The investigations are presently conducted from Washington, D.C., and from the various field headquarters (Fig. 1).

The program includes activities ranging from geologic mapping of areas on the frontier of oil exploration (as in the coast ranges in the Pacific Northwest) to subsurface stratigraphic and lithologic studies of Paleozoic rocks in the Mid-Continent region, studies of the distribution and origin of oil-producing limestone reefs in Texas, and research on the accumulation of oil and gas under hydrodynamic conditions. Fig. 1 shows the areas now being studied.

A small research laboratory in Denver provides laboratory data on the physical characteristics of rocks that are of particular interest to petroleum geologists. It also provides close coordination of laboratory work and field investigations. The research projects and service work of this laboratory will in the future be integrated with surface and subsurface geologic projects.

The program of investigations is under constant review. The fuels branch tries to assure that geologic work that can be done within the limits of available funds is being done either in those parts of the country where the need is greatest or in those phases of geology that are not being investigated by commercial geologists or geologists of other organizations, including universities and state geological surveys.

As a general rule, projects in frontier areas of oil exploration receive a higher priority than those in areas that have reached a mature stage of petroleum development. Even in these latter areas, however, many frontiers of geologic thinking remain unexplored. Such an area is the central Mid-Continent region where stratigraphic and lithologic studies by Survey geologists have helped solve vexing stratigraphic problems whose solution is leading to the discovery of new oil fields.

Effectiveness of program . . . Accomplishments in Geological Survey fuels work cannot be measured in terms of oil fields discovered or of increased production. Actual discoveries are properly made by companies and individuals risking capital in the hope of profit. The contribution of the Geological Survey is to make available the data that the petroleum geologist requires but is often not likely to obtain for himself under the conditions of his work.

The role of U.S.G.S. in oil discovery is illustrated by the development in the Williston basin in Montana, North Dakota, and South Dakota. The discovery is the direct result of initiative, enterprise, and effort by industry. But the effort was facilitated by the availability of data obtained by Geological Survey work in fuels geology.

Many years ago, Survey geologists pointed out that the Williston basin was a favorable area for the occurrence of oil and gas. During the war years, the Survey began studies of rocks exposed in areas in central Montana; these studies were expanded after 1945. Nearly all these areas contain rocks that extend eastward beneath the Williston basin. The information obtained by these studies was used in guiding the search for oil in the Williston basin. Stratigraphic and paleontologic studies are under way now of samples from wells drilled in the basin, and information thus gained will further aid exploration.

Publications . . . The results of Geological Survey investigations are made available to the mineral industries and the general public in a variety of ways. The principal mode of release of information is in the Geological Survey's own series of publications. Relatively complete and exhaustive reports are published as Survey bulletins and professional papers. These are available to petroleum geologists either by purchase from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., or, for older reports now out of print, available for reference at one of the hundreds of official depositories that receive a copy of every book-type Survey publication.

Much of the basic geologic data obtained in the Survey's oil and gas investigations is of such immediate interest that condensations are released in more informal ways than by publication as a bulletin or professional paper. Preliminary texts without large illustrations may be released as circulars. These are obtainable free on application to U.S.G.S., Washington 25, D.C. Geologic maps and graphic stratigraphic sections are published in the Survey's Oil and Gas Investigations series that include maps, charts, and brief texts.

A catalog listing all the geologic publications of U.S.G.S. may be obtained free from either Washington or Denver. New publications are announced in a monthly list which is available on request.

The Survey supplies current summary reviews of the status of the oil and gas resources of the nation or the world to other government agencies. In preparing these administrative reports, the Survey leans heavily on the accumulated and synthesized data supplied by the oil industry, such as the annual reports of the American Petroleum Institute.

In trying to look into the future, Survey geologists are no more clairvoyant than other individuals or groups in the oil business. The Survey does try to analyze the available information independently and judiciously, though it characteristically and perhaps appropriately leans toward the conservative view.

Thsu the Survey's reserve estimates made in the 1920s have proved to be much too low. But others directly engaged in the oil industry also greatly underestimated the oil potential of the nation, especially before the discovery of the East Texas oil field.

From time to time, special investigations are conducted for other government agencies, some of them of a classified nature, in the interests of national defense. A recent nonclassified special study was of the Scurry Reef, done in collaboration with the Bureau of Mines for the Petroleum Administration for Defense. Results of this study have contributed materially to more efficient development and production of the field.

Other contributions . . . The activities and publications of the Geological Survey thus far discussed are probably known—at least in part—to most geologists and executives of the oil industry. The Survey believes it has also contributed toward advancement of the industry and to scientific knowledge in other important though less familiar ways.

Industry cooperation . . . The success of some of our oil and gas investigations, particularly our subsurface work, depends in large part on contributions of cores and cuttings, other samples, well logs, and drilling and production histories supplied by companies or individuals.

Over the years, material and data have been generously and cordially furnished on request by almost all companies and many individuals, even at times including confidential data on "tight holes." In return, the Survey meticulously protects confidential data, clears with the companies that supplied information before publishing nonconfidential data, and tries to complete its work and publish its results as fast as possible so that the companies and individuals who assisted, as well as the industry and public in general, will have the benefit of the findings.

Future program . . . Many possibilities of service to the oil industry and petroleum geology in general must be considered in the formulation of the overall program and the choice of individual projects that make up the program of the fuels branch. Some of them are:

1. Selection of areas where regional petroleum studies are currently most needed.
2. Selection of areas of potential promise in which companies may be interested in the future.
3. Selection of promising fundamental problems in the field of origin and mode of accumulation of oil and gas.
4. Maintenance of significant amounts of research effort concentrated in relatively restricted regions so that comprehensive results can be obtained covering an entire area or basin in a reasonable number of years, rather than scattering projects all over the country with isolated local objectives.
5. Adjusting the projects that might be undertaken to the capabilities and talents of geologists available.
6. Coordination of projects with the programs of state surveys and the research of companies, university staffs, and individuals to avoid duplication of work.
7. Requests for special work from other governmental agencies.

All these possibilities have been considered in the formulation of the current U.S.G.S. program and will influence plans for future work. Inasmuch as one of the Survey's objectives is to advance the present and future successful exploration for oil by private enterprise, suggestions and comments from oil geologists and executives regarding its program or parts of it are always welcomed.

EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

In Buffington Township, Indiana County, Southwest Pennsylvania, Felmont Oil Corp. completed 1 Marjorie Shankel, rank wildcat with a final gage of the gas at 200,000 cu. ft., chert 8,230 ft., gas 8,234 ft., Oriskany sand 8,290-8,306 ft., total depth 8,317 ft.

• Gaskill Township, Jefferson County, Columbian Carbon Co. 1-1830 Harriett C. McClure is drilling at 680 ft.

• Kiskiminetas Township, Armstrong County, Fred M. Schreckengost et al No. 1 Wm. Schreckengost is at 5,240 ft.

WEST VIRGINIA

Union district, Preston County, West Virginia, Columbian Carbon Co. 1-1217 Theodore R. Rembold, wildcat, is drilling at 1,683 ft.

• Sherman district, Hampshire County, M. E. Anderson 1 J. E. and B. Orndoff is at 5,013 ft., with no additional gas.

• Meadow Bluff district, Greenbrier County, Clear Creek Oil & Gas Co. is drilling at 1,027 ft. in 1 James McClung.

TENNESSEE

Gas exploration is picking up in Tennessee this year. The focal point of the drilling activity is Anderson County. One well in that county is producing 1,000 M.c.f. per day. Five wells are planned for the area in the near future. The Briceville discovery of 1954 has sold more than 16,000 M.c.f. of gas in the past 10 months.

The county's second gas well is now nearing completion. It is the Nelson Oil & Gas Co. 1 Boos, between Briceville and Clinton on the same tract on which the original well was drilled. The Boos reached a depth of 3,300 ft. with oil and gas shows reported. The well will be shot to increase the gas flow. Another well in the county is down to 750 ft. It is being put down by Dr. W. W. Mash. Another well is drilling 1,385 ft. northwest of the Briceville discovery well, also by Dr. Mash. Columbian Carbon Co. will drill a wildcat at Devonia in Anderson County. Contract has been let for the operation.

Columbian will also drill another well near Norman in Scott County, over the Anderson County line. That company will drill a total of five wildcats in Anderson and Scott counties.

Other wells drilling or planned for the region are: W. F. Lacy at Vasper, down to 750 ft. with gas flowing at 730 ft.; David-Stacy well, 1 mile north of La Follette, down to 803 ft. Dr. Mash has a well at Pruden on American Association Land Co. property. That well is drilling at 705 ft. Good gas shows were reported at 630 ft.

Shell Oil Co. is at 3,200 ft. at a wildcat near Crab Orchard. This is the first rotary test to be put down in eastern Tennessee. Sun Oil Co. has acquired a 42,000-acre lease south of the Shell well. Drilling will begin immediately.

In Campbell County a wildcat is due to begin drilling operations on the Elk Valley Coal & Iron Co. property, between Pioneer and Newcomb.

OHIO

Two extensions were reported in the Glenford area in Hopewell Township, Perry County: Foraker Jr. 1 (3) Iva Love, Section 8, with Clinton at 2,732-51 ft., made a good show of oil natural and 175 bbl. and an estimated 1,000,000 cu. ft. gas in a 24-hour test after fracture; in Section 7, National Gas 2 Ralph Yost found the Clinton at 2,736-42 ft. with 180,000 cu. ft. natural and an estimated 2,000,000 cu. ft. after treatment.

• In Perry Township, Coshocton County, the field was extended to the east of the Pan-Ohio 1 (2) H. G. Mikesell, Section 5, Clinton at 3,235-86 ft. made 4 bbl. natural and 320 bbl. in a 24-hour test after fracturing.

• National Gas moved over three dry holes and either extended its Newburg pool in Walnut Township, Fairfield County, or made a discovery. Sand in the G. Wiseman, Section 13, was topped at 1,965 ft. and drilled in to 1,996 ft. with 1,200,000 cu. ft. natural.

EASTERN INTERIOR

ILLINOIS

In Richmond County, 6 miles north of Olney, J. W. Rudy is finishing up at his 1 Stiff in the NW SE SW 34-5n-10e. The well is producing from the Rosiclare at 2,919-25 ft. Recovery on a drill-stem test was 650 ft. of clean oil, 75 ft. oil-mixed mud. This discovery is 1 mile from production.

• In Sangamon County Otto Krachik's 2 Smith in SE SW SE 12-14n-4w, is a 2-mile discovery. The well, 2

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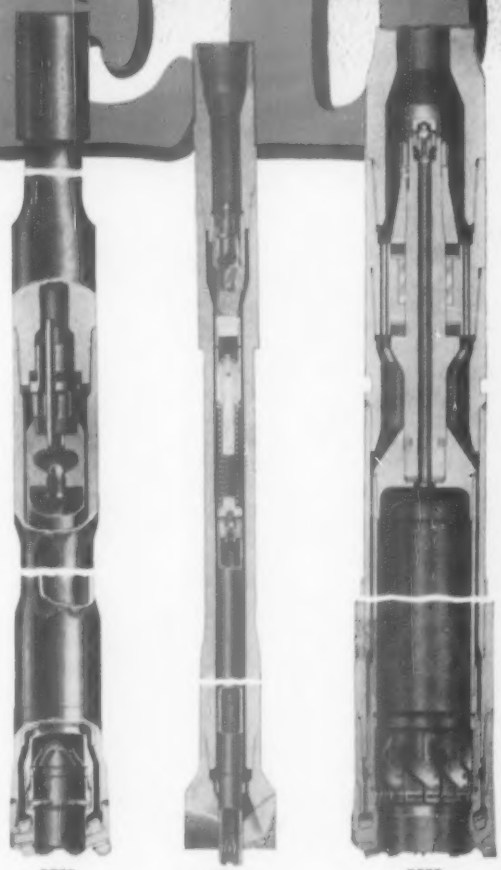

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miles east of New City, finaled in the Hardin sand at 1,734-42 ft. The well pumped and flowed 200 bbl. per day after fracturing.

• In Wabash County Miller-Beard 1 E. E. King, E½ NW SW 21-1n-12w, flowed clean oil on a test of the O'Hara lime at 2,285-94 ft. This well is 2 miles from O'Hara oil production, and is a ¾-mile discovery 2 miles southwest of Allendale, Illinois.

• A 1,200-bbl.-per day well is reported at Glenn L. and Maxine Bryant 1 G. T. Johnson in NE NW SE 21-6s-5e, Hamilton County. The wildcat is producing from the Aux Vases at 3,202-34 ft. It is located 1½ miles north of Rural Hill.

• Edwards County has a new producer at C. C. Beebe 1 Ben Miller, SE SE NW 7-3s-14w. The well pumped 135 bbl. of oil per day, natural. The Rosiclare is the pay at 3,096-3,104 ft.

GREAT LAKES

MICHIGAN

A new basal Salina-Niagara gas discovery well was under test in Romulus Township, Wayne County, at The Taggart Co. 1 Moore, et al, SE NE NE 16-3s-9e, the first of two follow-up tests drilled in the area to log gas pay since a core drilled by International Salt Co. for geological salt information unexpectedly drilled into a pay in this horizon and blew out earlier.

The new Taggart gas discovery logged pays which showed for over 2,000,000 cu. ft. a day between 1,970 and 2,160 ft. Total depth was reached at 2,241 ft.

This new wildcat strike is located about ½ mile north and west of the International Salt Co. core hole which pointed this area up as a potential gas pool. The core hole blew out, probably in A-1 dolomite, and gas was estimated at 8,000,000 cu. ft. a day. This core hole was just off the sprawling Wayne County Airport, restricted area, which eliminates, at least for the present time, much of the likely looking acreage in the play.

First follow-up test in area was drilled by Sun Oil Co. in the SE SW SW 10-3s-9e, about a ½ mile northwest of core hole. The Sun wildcat, which was drilled out dry in Salina-Niagara, was structurally about 120 ft. lower than core test well on objective horizons. The Taggart Co. discovery appears to have split the difference structurally with Sun's wildcat and International's core test. Discovery is 60 ft. higher than the failure and 60 ft. lower than core test.

MID-CONTINENT

KANSAS

Ft. Scott Discovery Now Testing Mississippian

Ohio Oil Co. is testing in the Mississippian at 4,506-13 ft. at the 1 Vermillion in C SW NE 6-17s-24w, Ness County.

The wildcat is a promising Ft. Scott lime-Des Moines discovery. A drill-stem test run at 4,386-4,404 ft. got 2,440 ft. of gas, 513 ft. of gassy oil, 61 ft. of oil and gas-cut mud with bottom-hole pressure recorded at 1,240 psi. The second test at 4,385-95 ft. recovered 2,444 ft. of gas, 234 ft. of gassy oil, and 30 ft. of muddy oil. Bottom-hole pressure was 1,280 psi. This wildcat is 3 miles southwest of Arnold field. It is 11 miles northwest of Ness City, Kansas.

Lansing-Kansas City Hit Reported in Schmied Area

Graham County has a promising Lansing-Kansas City well at Cities Service Oil Co. at 1 Blazier, NE SW SE 21-7s-25w. Recovery on a drill-stem test at 3,788-3,811 ft. was 3,390 ft. clean gassy oil. A previous test made at 3,726-56 ft. made 1,160 ft. of clean gassy oil and 420 ft. muddy oil. This wildcat prospect is located 5 miles north of Morland, Kans., in the area 4 miles north of Schmied field.

NORTH TEXAS

Oil String Set at New Jack County Pool Opener

Warren Petroleum Corp. has a new Marble Falls conglomerate pool opener. It is the 1 Ada Worthington in the central portion of Jack County, 5 miles northeast of Jacksboro and 1½ miles southeast of present production.

The operator has set oil string at 5,395 ft. A drill-stem test at 5,338-5,523 ft. recovered 165 ft. of heavily oil-cut mud and 3 ft. of free oil. This wildcat prospect is located in the J. Y. Collier Survey A-136.

OKLAHOMA

Continental Gives West Short Junction New Well

Hunton lime oil production has moved 40 acres to the east in West Short Junction field, Cleveland County.

Continental Oil Co.'s 1 Butler in C NW NW 23-10n-4w, flowed 867 bbl. of 37°-gravity oil per day after fracture treatment. Perforations were at 8,012-8,106 ft. in the Hunton. Flow was on 22/64-in. choke.

Basal McLish Producer Finaled at North Madill

North Madill field in Marshall County has a new producing well. It is Stanolind Oil & Gas Co.'s 1-A Griffin in SE NE NW 16-5s-5e. The well was good for 756 bbl. of flowing oil per day on 24/64-in. choke. Perforations were at 6,500-10 ft. Production is natural and gravity is 38°.

Former Dry Hole Is Red Fork Sand Strike

The Texas Co. took an old dry wildcat in Grant County, northern Oklahoma, reworked it and came up with a good Red Fork sand discovery. That firm's 1 Young, C SE SE 18-27n-5w, made its final test last week. The well flowed 80 bbl. of oil and 6,500 M.c.f. of gas per day on 30/64-in. choke from perforations in the sand at 4,860-75 ft. after fracturing. Gas-oil ratio was 82,250:1. Oil gravity is 61.6°.

West Chitwood Pool Extensions Is Complete

West Chitwood field in Grady County has been successfully extended to the northwest at The Texas Co. 1 Mutz, C SE SW 24-5n-7w.

The Deese sand extension well pumped 183 bbl. of 35.2°-gravity oil per day after treatment. Perforations were at 9,658-69 ft. The Deese was topped at 9,645 ft.

Utah Southern Oil Co. has an apparent Pennsylvanian lime discovery well in remote wildcat territory. The 1 Pope is located in 10-18n-9w, Kingfisher County, 16 miles southeast of big Ringwood field, closest production.

Testing Under Way at Kingfisher Prospect

The sudden spree of remote wildcat tests in Oklahoma has shown more prospects. This time it is a Kinglisher County well in northern Oklahoma. Utah Southern Oil Co. landed casing last week at their 1 Pope in SW SE NW 10-18n-9w. The operator found a gas showing in the Pennsylvanian lime at 7,270-80 ft. A blowout was prevented. On test the well flowed 300,000 cu. ft. of gas per day natural. Objective of the well is 9,500 ft. The lime zone will be treated with acid, it is reported.

Pennsylvanian Gas Flows At Old Alfalfa Wildcat

An old workover well in Alfalfa County, northern Oklahoma, reported 1,370 M.c.f. of gas per day from basal Pennsylvanian said. The indicated strike is Continental Oil Co.'s 1 Maltbie in the SW NW SE 8-28n-9w.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Important Morrow Strike Completed in Ochiltree

Ochiltree County has a new Morrow sand producing area as a result of The Texas Co.'s successful completion at 1 Leonard Barlow in Section 929, Block 43, H&TC Survey, 4½ miles southeast of Perryton.

The Morrow field-opener flowed 1,120 M.c.f. of gas per day with no gage reported on the distillate flow. Perforations are at 7,962-81 ft. This is a rank wildcat discovery, located about 12 miles southeast of nearest production at Fulton 1-54 Share, a shut-in Morrow discovery. It is also located about 15 miles northeast of Farnsworth-Morrow field, a one-well pool.

Morrow Discovery In Hansford Awaits Potential

A new Morrow gas discovery is shut in for potential at Lamar Hunt Trust Estate 1 Charles O'Laughlin, Section 59, Block 45, H&TC Survey, 10 miles northeast of Spearman.

The well made final company gage of 1,400 M.c.f. of gas per day after fracture from perforations at 7,094-7,106 ft. The gas is wet. Location is 1½ miles southwest of the 1-A Brilhart, a Cities Service Oil Co. Tonkawa-Pennsylvanian gas pool. It is 2½ miles northeast of Twin-Morrow field, one of

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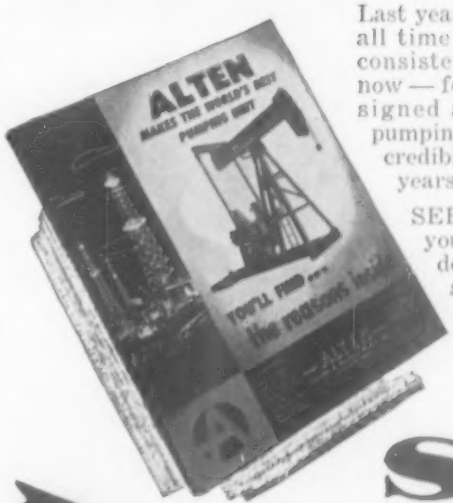

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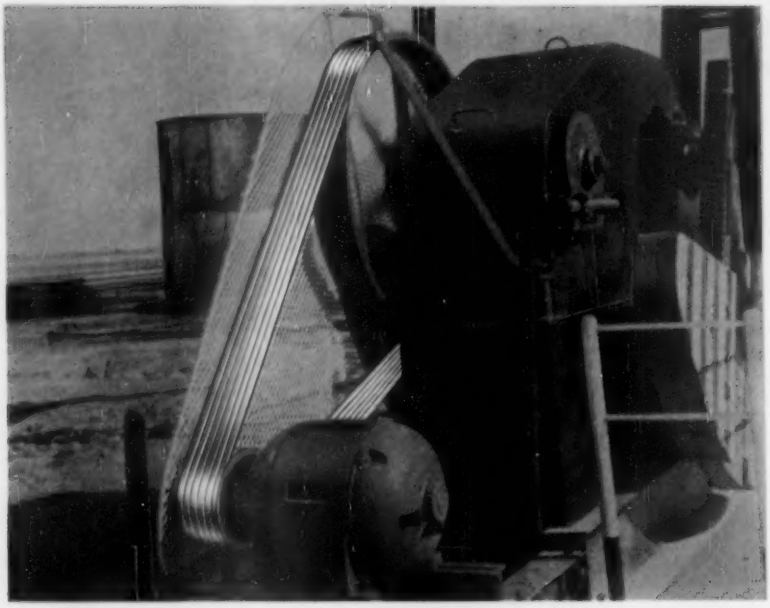

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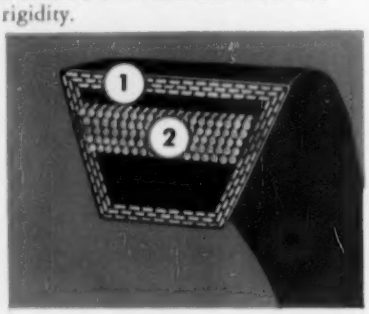

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SOUTHWEST KANSAS

Two Ness County Tests Take Kansas Interest

The big wildcat region west of the Central Kansas uplift captured the exploratory interest in Southwest Kansas last week. Ness County is the scene of an intensified oil and gas search.

Two wildcats in the county have indicated success. Millison & Beebe 1 Davenport in the NE NE SW 36-16s-21w, 20 miles northeast of Ness City, recovered 850 ft. of gassy oil on a drill-stem test at 4,037-55 ft. The zone is believed to be Mississippian. This test is 9 miles southwest of nearest production at Kutena field. It is 25 miles west of nearest Ness County production at Arnold field.

The Ohio Oil Co. has a prospective hit at their 1 Vermillion in SW NE 6-17s-24w, 3 miles from Arnold. This wildcat recovered 2,444 ft. of gas, 234 ft. gassy oil, and 30 ft. muddy oil on a drill-stem test at 4,385-95 ft. The wildcat prospect is 4 miles southeast of Northeast Aldrich field (Fort Scott and Warsaw production).

OKLAHOMA PANHANDLE

Mocane Area Extension Well Takes Potential

Potential was reported on United Producing Co.'s 1 Otto Barby, a 2-mile southeast extension to Morrow gas production in the Southeast Mocane-Northwest Knowles area. The well, located in SE NW 34-5n-26eCM, flowed 3,070 M.c.f of gas per day. Shut-in pressure was 1,460 psi. Perforations in the Pennsylvanian Morrow were at 6,785-99 ft. This new extension to the prolific gas-condensate area building up in Beaver County is located about 3½ miles southwest of Knowles townsite. Cabot Carbon Co. plugged the 1-mile south outpost well to the United Producing success. No shows were recovered on drill-stem tests of the Morrow and Oswego formations.

Wildcats Slated For Harper, Texas County

Rank exploration in Northwest Oklahoma will receive another boost with the announcement of out-of-the-way wildcats in Harper and Texas counties.

Musgrove Petroleum Co. will drill a 6,000-ft. Mississippian test at 2-23 Wacker in SE NW 23-4n-13eCM, 9 miles northwest of Guymon in Texas

County. The test will go down in an area 18 miles southeast of Morrow production at Northwest Eva field. It is located 18 miles southwest of the recent Burdge discovery which opened first inside-Hugoton Morrow production in Oklahoma.

Harper County . . . John P. Booth of Tulsa will put down a 6,500-ft Morrow wildcat in the SE SW 36-29n-23w, 13 miles northeast of a small Pennsylvanian gas producing area in Harper County. His 1 Brown is spotted 4½ miles northeast of a dry hole drilled by Sunray-Mid Continent Oil Co. at 1 Vanderpool.

First Commercial Gage Reported at Beaver Test

Beaver County in the Oklahoma Panhandle, scene of 1955's exploratory race in the Hugoton embayment, has another discovery. This one is in the southern part of the county, an area of bright promise for production.

Helmerich & Payne, Inc. 1-B Juett Bennett, SW NE 2-3n-25eCM, 2 miles southeast of Riverside, Oklahoma, and 6 miles northeast of Southwest Camp Creek field, flowed 1,450 M.c.f. of gas per day. Perforations are at 5,412-33 ft. in the Douglas-Virgil. This is the first Douglas production in Beaver County. The Douglas now produces in the three-state Hugoton embayment area. In Texas it produces at Gruver, Hitchland, and North Hansford fields in Hansford County. The formation has scattered production in Southwest Kansas. This Helmerich & Payne discovery well also had some gas shows in the Mississippian and Cherokee-Des Moines.

Camrick Field Now Embraces Two County Areas

Big Camrick field, formerly confined to southeastern Texas County, has now moved across the county line into Beaver. The field continues to expand, particularly to the north and northwest.

Kansas-Nebraska Natural Gas Co. 1 Jones, NW NW SE 13-2n-16eCM, recently moved the field 2 miles north, flowing 27,500 M.c.f. of Morrow gas per day. Perforations were at 6,464-6,536 ft. To the southeast the 1 Washburn in NE NE SW 19-2n-19eCM, flowed 5,100 M.c.f. of gas per day with some distillate on test at 6,551-81 ft.

Carter Oil Co. added two oil wells to Camrick recently. The 1 Sutton moved the field 4¾ miles northwest flowing 504 bbl. of oil per day on ½-in. choke. Production is from Morrow. Testing is underway at the first oil well on the Beaver County side of the field. The 1 Manning swabbed 99 bbl. of oil in 9 hours on the most recent test reported in the Morrow.

Two Counties Still Lead Regional Exploration

The Hugoton embayment continues its lead in Mid-Continent exploratory and development interest. Two counties, Hansford and Beaver, still command the region's interest.

No. 1 . . . Hansford County, Texas, is at the top of the class in the discovery and development race in the embayment. Five producing sands in 10 producing areas make this county the heart of the pre-Permian play.

. . . 1955 activity. The outstanding feature of this year's activity in Hansford County is the linking-up of scattered fields into one extensive five-pay reservoir in the north-central part of the county. The North Hansford producing area was opened last year. At year's end there were three pay zones . . . Now there are five. The latest addition to the growing list of pre-Permian pays is the Douglas sand (Virgil - Pennsylvanian). The Douglas sand discovery belongs to Cities Service Oil Co. The 1 Vernon "A" flowed gas from the upper Douglas at 4,832-80 ft.

Earlier this year the biggest gas-dis-

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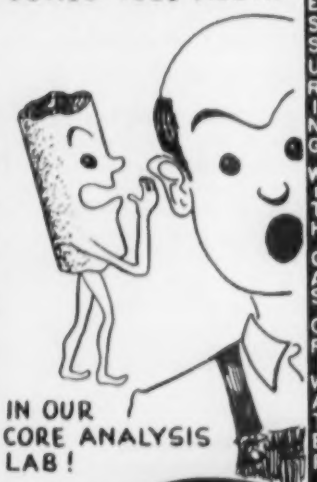

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Here are the two busiest counties in the Hugoton pre-Permian region.

tillate producer in the entire Hugoton embayment was completed in Hansford County. The record-breaking well is Sharples Oil Corp.-Baker-Taylor Drilling Co. 1 Boyd, 12 miles northwest of Spearman, Tex. It flowed 109,000 M.c.f. of gas and 545 bbl. of distillate per day from perforations at 5,324-82 ft. in the Tonkawa-Missouri sand.

It now appears that the entire north-central portion of Hansford County is one large multipay oil and gas-distillate reservoir. There are no signs of let up in development and step-out drilling for the rest of the year.

No. 2 . . . Beaver County, Oklahoma. The 7-month score of success in Beaver County this year is five new oil fields, six new gas-distillate fields; five oil development completions and three gas-distillate field-well completions.

This year's most significant new field in the county is at Northwest Mocane. This area has flowing production from the Kansas City and Checkerboard lime plus gas production in the Morrow sand. The area for future exploration in Beaver County appears to be in the southeastern part of the county. Four tests are under way in this rank wildcat territory. Two of them are showing success as Morrow gas discoveries. One indicated discovery is Colorado Oil & Gas Co. 1-3 Armstrong in SW SW 3-2n-27eCM, 16 miles from nearest production at Southwest Camp Creek field. This Morrow well will be the focal point of an extensive confirmation drilling program. The other indicated discovery is Union Oil Co. of California 1 Parker, 12 miles south of Beaver City. This well flowed 9,100 M.c.f. of gas per day on drill-stem test of the Morrow. It is located in a vast untested area of the county. A recent success to the east of Beaver County in Harper County adds even more impetus to the important northwestern Oklahoma play.

Dark cloud looms . . . The only splotch on this otherwise bright exploratory picture is the lack of pipeline outlets in Beaver County's new Mocane producing areas. Average daily production from Beaver's distillate fields is 10-20 bbl. per well. One field is producing 75-80 bbl. per day per well. Gas production depends on outlet facilities. The daily allowable for July in Hansford County's gas areas is 3,600 M.c.f. Here again outlets hold the key to the region's growth.

WESTERN CANADA

ALBERTA

Viking Gas Hit At Rosedale Area Wildcat

Socony-Vacuum Oil Co. of Canada, Ltd., hit a large gas flow on a Viking sand drill-stem test at the Rosedale area wildcat in central Alberta.

This well, Socony-CPR 2-10 Rosedale, LSD 2, 10-28-20w4, is 3½ miles northwest of Wayne area basal quartz oil wells and 2½ miles southeast of a dry hole at Stockton. On test of the Viking sand at 3,680-3,735 ft. gas flowed at 5,210 M.c.f. per day. Drilling is now below 3,735 ft.

South Stony Plains Discovery Completed

Devon Leduc Oils, Ltd., et al have completed a discovery well in the South Stony Plains area of Alberta. The well is the Royalite-Canadian Gulf-Devon Leduc 1 Stony Plains. It is on a unitized block of 3,200 acres in which Devon Leduc has 33 per cent interest. The well flowed at the rate of 405 bbl. for 24 hours of 38°-gravity oil. The allowable is 100 bbl. per day. This south extension of Stony Plains field would appear to prove locations for a large number of additional wells.

SASKATCHEWAN

Jurassic Oil Found At Loomis Area Wildcat

Tide Water Associated Oil Co. has found oil at their Loomis area wildcat,

14½ miles southeast of Eastend and 75 miles southwest of Swift Current. This wildcat, Tide Water 1 Frechman Crown, LSD 8, 29-4-20w3, is 4 miles northwest of Rapdan area oil production and 9 miles south of Eastend field production.

Recovery on a drill-stem test in the J2B member of the Jurassic at about 4,625 ft. was 1,320 ft. of clean oil. About 13 ft. of pay section was found.

PACIFIC COAST

CALIFORNIA

New Tejon Find In Prospect

A wildcat 2 miles northwest of production in the Tejon area of southeast San Joaquin Valley has indicated it will result in a new field discovery. The test, C. F. Wehr 63-20 Butler-Wehr, reportedly yielded salt water at its 9,537 ft. total depth. When 7-in. casing, set at 7,700-ft., was perforated at 7,430-50 and 7,460-80 ft. the well started flowing by heads at an undetermined rate.

The discovery is believed to be in the Olcese of middle Miocene age. These sands are productive at approximately 5,600 ft. in the Tejon-Grapevine area 2 miles southwest. A formation test at 6,620-6,744 ft. indicated an upper Miocene sand also may be productive. Located in SW NE 20-11n-19w, the discovery is on a Reserve Oil & Gas Co. leasehold.

New Colusa Gas Field

Honolulu Oil Corp., jointly with Humble Oil & Refining Co., has scored a new gas find in the Princeton area of Colusa County. Located about 4 miles south of production, 1 Tuttle Unit flowed 2,030 M.c.f. daily from 2,380-95 ft. Production was through a 20/64-in. choke. Site of the discovery is in NE NW 12-17n-2w.

Coalinga Test Watched

The Texas Co.'s wildcat at Guijarral Hills, Fresno County, was nearing a critical depth as it drilled ahead for 10,600-ft. Eocene sands which are productive in the Polvadero area 2 miles south. The test, 1 Spieler in SE SE 26-20s-1e, was below 10,250 ft. at last reports. About 1 mile northeast, in SW Section 24, Santa Fe Drlg. Co. 27X Guijarral Service was testing at 11,507 ft.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Strawn Is Second Pay At Sheffield Offset Well

The Strawn is flowing oil on drill-stem test at 9 bbl. per hour at Standard Oil Co. of Texas et al 2 Cannon, the northeast offset to the Standard Sheffield Ellenburger discovery 10 miles southwest of Iraan in Pecos.

The Strawn test was made at 7,560-7,600 ft. The well is drilling ahead below 7,700 ft. Previously, the well flowed oil on a test at 6,700-35 ft. in the Cisco lime. This discovery is in Section 18, Block C-3, EL&RR Survey.

Upton King Mountain Hit Runs Pipe for Completion

Hunt et al 1 Barnett, ½-mile northwest outpost well to King Mountain Ellenburger field in Upton County, is preparing to complete. Casing was run to 11,970 ft., total depth. The well flowed an estimated 110-120 bbl. of oil per hour on a drill-stem test at 11,898-970 ft. This well is the outpost to the only well in King Mountain field. Location is in Section 86, Block Y, GC&SF Survey. It is 11 miles west of the town of McCamey, Tex., and is in the western portion of the county.

Palo Pinto Reef Strike Finaled in Taylor County

Taylor County in West-Central Texas has a new Palo Pinto reef producing area at Snuggs & Neal and Perini 1 Elmer Griffith, Section 31, BAL Survey.

The good strike, 3 miles east of Abilene, flowed 186 bbl. of oil per day. This test was based on a 15-hour potential. The flow was on ¼-in. choke from perforations at 3,290-3,300 ft.

Nolan Strike Adds to Border Counties' Play

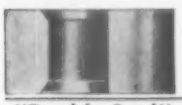
Clarence L. Norsworthy, Jr., has another Nolan County discovery at his 1-A Compton 9 miles southwest of Maryneal in the southwest part of the county.

The well flowed 160 bbl. of oil in 5½ hours on 12/64-in. choke from perforations at 6,980-7,005 ft. Production is from the Strawn reef limestone topped at 6,882 ft. The wildcat is in the NE NE Section 93, Block 1-A, H&TC Survey. It is 3½ miles southwest of new Venamadre Strawn and Odom lime field, another Norsworthy and Pure Oil Co. field. It is 5 miles southeast of another recent Strawn reef discovery at Union-Sun 1 Wallace.

Devonian Oil Reported Flowing at Yoakum Test

The northwest confirmation well to the Seagraves (Sil-Dev) field in Gaines County reported flowing Devonian oil last week. The discovery, inside the Yoakum County line, is Anderson-Prichard Oil Corp. 1 Nora Powell, Section 30, Block C-35, PSL, 5 miles west of Seagraves, Tex.

The extension and confirmation dis-



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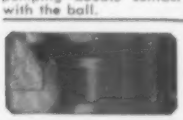

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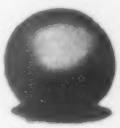

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covery flowed 70 bbl. per hour for 12 hours. It is shut in. Casing is being set for completion. The Devonian's top was found by samples at 13,035 ft. This is 2 ft. low to the field discovery well.

ROCKY MOUNTAIN

MONTANA

Glacier Park Area Discovery Tested

Union Oil Co. of California recovered gas at the rate of 6,000 M.c.f. per day and distillate at the rate of 250 bbl. per day on test of 1 Morning Gun, C SW SW 18-31n-11w, in the East Glacier Park area, Glacier County.

The well made gas on drill-stem test of Madison several weeks ago, but the current test is the first since casing was landed. Test was of 40 ft. of perforations in Madison at 8,962-92 and 8,998-9,008 ft. Flow in 5-hour test was at the 6,000 M.c.f. per day rate, through open line with back pressure of 550 psi. Actual recovery of distillate in the 5-hour test was 52 bbl. The zone was acidized before test.

Madison was topped in this wildcat at 8,959 ft., and the operator reported the well still in that formation at total depth of 9,559 ft. The tested zone is only a part of the Madison section which had shows in cores, and Union will continue to test in lower zones before completion.

The discovery is the second deep test in the United States portion of the Disturbed Belt fronting the mountains through northwest Montana. Although other wells in the Disturbed Belt . . . east of the current discovery . . . have had shows, the Union wildcat is the first which will apparently go to commercial completion. It is 65 miles south of Pincher Creek in Alberta, similarly located with respect to the Disturbed Belt, and producing gas from a corresponding zone.

Some Montana observers classify the discovery as possibly the state's most important since the discovery of oil in the Montana portion of the Williston basin in 1951. It opens the entire Disturbed Belt area from the border south to Lewis & Clark County to optimistic exploration.

The area has been highly regarded as a potentially rewarding province for some time. Several major companies hold extensive acreage through the Disturbed Belt area, and paid substantial bonuses for much of it at Blackfoot Indian lease sales.

Union is drilling another Madison test 12 miles south of the discovery at 1 Mittens, C NE NW 12-29n-11w, Pondera County.

New Eastern Montana Discovery Promised

Rothschild Oil Co. has recovered oil on test of Red River (Ordovician) at 44-15 Northwest Improvement, C SE SE 15-9n-59e, Fallon County. On 2½-hour test at 9,441-51 ft. recovery was 710 ft. of oil and 50 ft. of mud. Flowing pressure was 315 psi. at the end of the test. A second test at 9,451-71 ft. recovered only mud, with no shows. The operator is drilling below 9,550 ft.

The wildcat is 7 miles southeast of Cabin Creek field and 8 miles north of the 1955 discovery in the Pennel area. It is east of the crest of Cedar Creek anticline, and 14 miles north of Fertile Prairie, where production from Ordovician is located at a comparable distance east of the anticline.

Bredette Confirmation Failure in Charles

The California Co. recovered only water and mud in a series of five drill-stem tests in Charles at 1 Tribal-13, C SW NW 19-32n-50e, in the Bredette

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area of Roosevelt County. The well is an intended confirmation of this operator's discovery in the area, ¾ mile northwest of the current well. Production in the discovery is from Charles C zone. At last report the second Bredette well was drilling below 6,775 ft.

Carbon County Deep Test Dry

Phillips Petroleum Co. will abandon 1-A Louma, NE NE 28-6s-20e in the Luther-Fox area of Carbon County. Total depth is 11,800 ft., and top of Madison was found at 10,923 ft. No shows were reported in the wildcat except for a drill-stem test in Dakota at 9,291-9,347 ft. where a small amount of free oil was recovered.

NORTH DAKOTA

Spacing Hearing Held for New Bottineau County Field

Lion Oil Co. has requested temporary 40-acre spacing in the newly discovered North Souris field, Bottineau County. The company reported recovery of oil at the rate of about 11 bbl. per day on pump tests of the discovery, 1 Skarphol, C SE NW 33-164n-77w, with the total recovery cutting to 30 or 40 per cent water. The state industrial commission has not acted on the spacing request.

Burke County Deep Test Nearing Critical Depth

Texota Oil Co. is drilling below 5,500 ft. at 1 Ely, C SE NE 2-163n-93w with Spearfish sample top called at 5,380 ft. The well is almost midway between Tioga field and production at Fobisher in Canada. There has been very little previous drilling in this area. The wildcat will test Mississippian.

WYOMING

Clareton Area Study Completed

High gas oil ratios have restricted production on 135 of 608 wells surveyed in the Greater Clareton area of Niobrara, Weston and Converse counties, but the shutdown wells present less than 9 per cent of total production available from the area.

The survey of gas oil ratios in the field followed shut down of wells producing more than 5,000 ft. per bbl. on orders of the Wyoming Oil and Gas Conservation Commission.

During 1953 and 1954 this was the most active development area in Wyoming, but drilling has slowed through the area as production problems were encountered. The reservoir is gas-drive, with low percentage recoveries predicted if sound production practices are not stringently observed.

Walker Dome New Pay Possibility Seen

Ohio Oil Co. recovered 450 ft. of free oil in a test of Frontier at 4-E Smith-B, SW NE NW 9-46n-99w, in the Walker Dome field, Hot Springs County. Test was of the interval 3,254-3,349 ft., with tool open 5 hours. Previous drilling in the field had found gas in Frontier in small quantities, but no previous oil recovery has been reported. Production in previous wells is from Phosphoria.

COLORADO

Las Animas Arch Discovery Completed

M. J. Stansbury, Bakersfield independent has completed a dual zone discovery on the Las Animas arch 10 miles northeast of the town of Los Animas in Bent County. The well, 1 Cordes & Oberlander, C SW SW 21-

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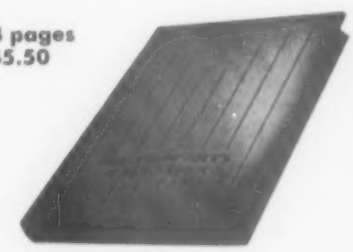

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21s-51w flowed 50 bbl. of oil per day from perforations in Atoka at 4,619-31 ft. Recovery from Morrow at 5,203-27 ft. was gas at the rate of 400,000 cu. ft. per day. This zone made nearly 2,000 M.c.f. per day on early test. Both Atoka and Morrow are of Pennsylvanian age. The new field has been named Beacon pool. A confirmation has been staked by Western Natural Gas Co. at 1 Bishop, C NE NE 29-21s-51w.

The discovery is the first of apparent commercial significance on the Las Animas arch. Early reports of oil and gas recovery resulted in a substantial leasing play through the Las Animas arch area.

GULF COAST

TEXAS GULF COAST

New Gulf of Mexico Test Drills Off Nueces County

Atlantic Refining Co. has a new rank wildcat operation in the Gulf of Mexico off the Texas Coast. Location is 12 miles east of Port Aransas in Federal Tract (OCS) 726, Mustang Island area, bordering Nueces County. Drilling is in 47 ft. of water, using a CATC barge.

Location also is 20 miles northeast of Gulf Oil Corp.'s gas-condensate discovery well in State Tract 889, same area. Gulf's well, shut in since completion last January, with pay interval at 11,452-86 ft., is 3½ miles offshore (Mustang Island).

Atlantic's test is the third to be undertaken in Mustang Island area since completion of Gulf's well. Shell Oil Co. is drilling in State Tract 884, northwest of Gulf's discovery well. It is down 13,350 ft. with permitted depth of 14,000 ft.

Humble Oil & Refining Co. has a new operation in State Tract (large) 772, with location 1,320 ft. southeast of Gulf's well.

Large Gasser Uncovers New San Patricio Field

Forest Oil Co.'s new discovery well 7 miles northeast of Sinton, in San Patricio County, is rated good for 67,000,000 cu. ft. of gas daily, open flow. Condensate recovery is at the rate of 16.7 bbl. per million cubic feet. Flow during completion test through ¼-in. choke was under pressure of 2,274 psi. Shut-in pressure is 2,387 psi. Gravity of the condensate is 61.7°. Production is from upper Frio sand, perforated at 5,952-64 ft.

Wildcat Gasser Completed

A new gas-productive area has been opened in northern Wharton County. Its discovery well, Acco-Colorado-Amurex 1 Heyne-Obenhaus Unit, is located 5 miles southwest of Bonus, in the Joseph Newman Survey, and about the same distance west of the Egypt area. Flow through 5/32-in. choke while cleaning was under pressure of 2,450 psi. The well has been shut in without gage of volume. Shut-in pressure is 2,650 psi.

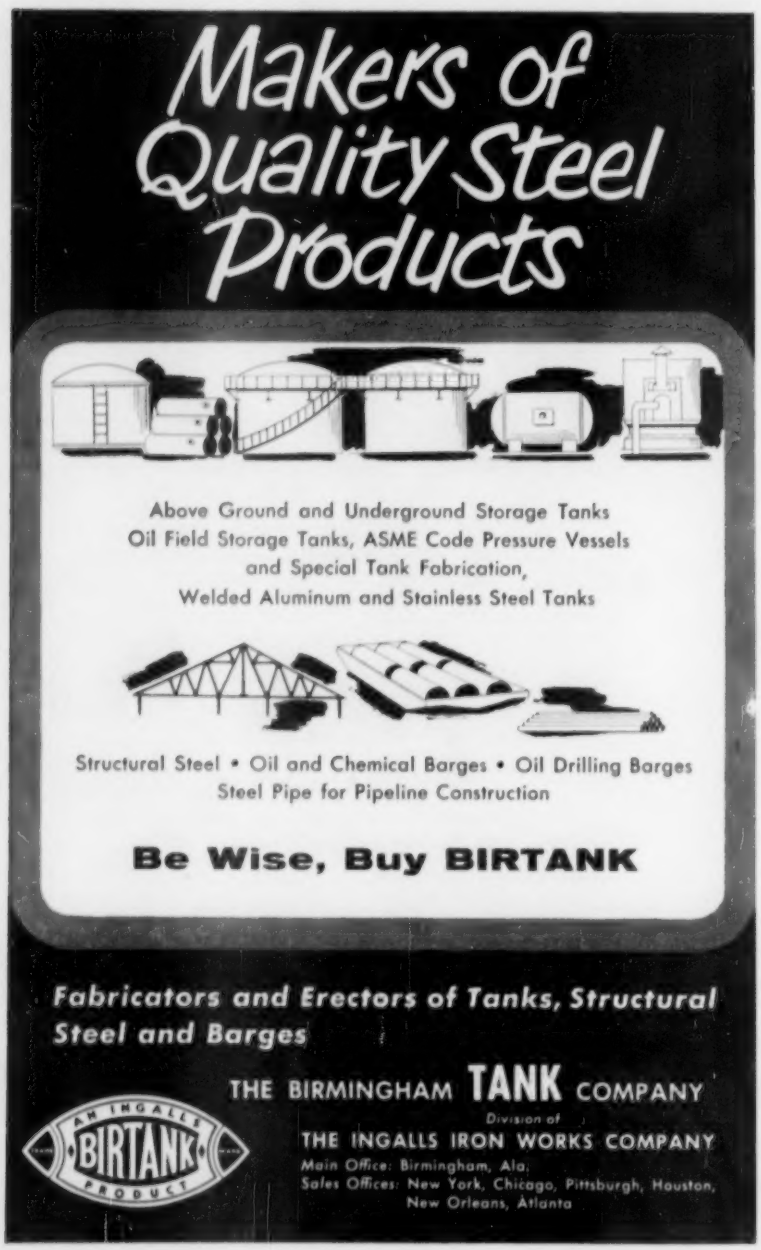
New Gas Area Opened

Milton V. Spencer and associates have a new gas discovery well southeast of Mustank Creek field, 7½ miles northwest of Garwood, in Colorado County. It is their 1 Kallina, in I&GN Survey 15, which flowed at an ungaged rate with pressure of 1,410 psi. through ⅛-in. choke. Completion is in sand at 3,509½-10½ ft. Production at Mustang Creek, slightly more than ½ mile northwest, is from sand at 8,883-91 ft.

SOUTH LOUISIANA

Sunset Area Discovery Yields Gas-Condensate

Columbian Carbon Co. has a new gas-condensate discovery well in the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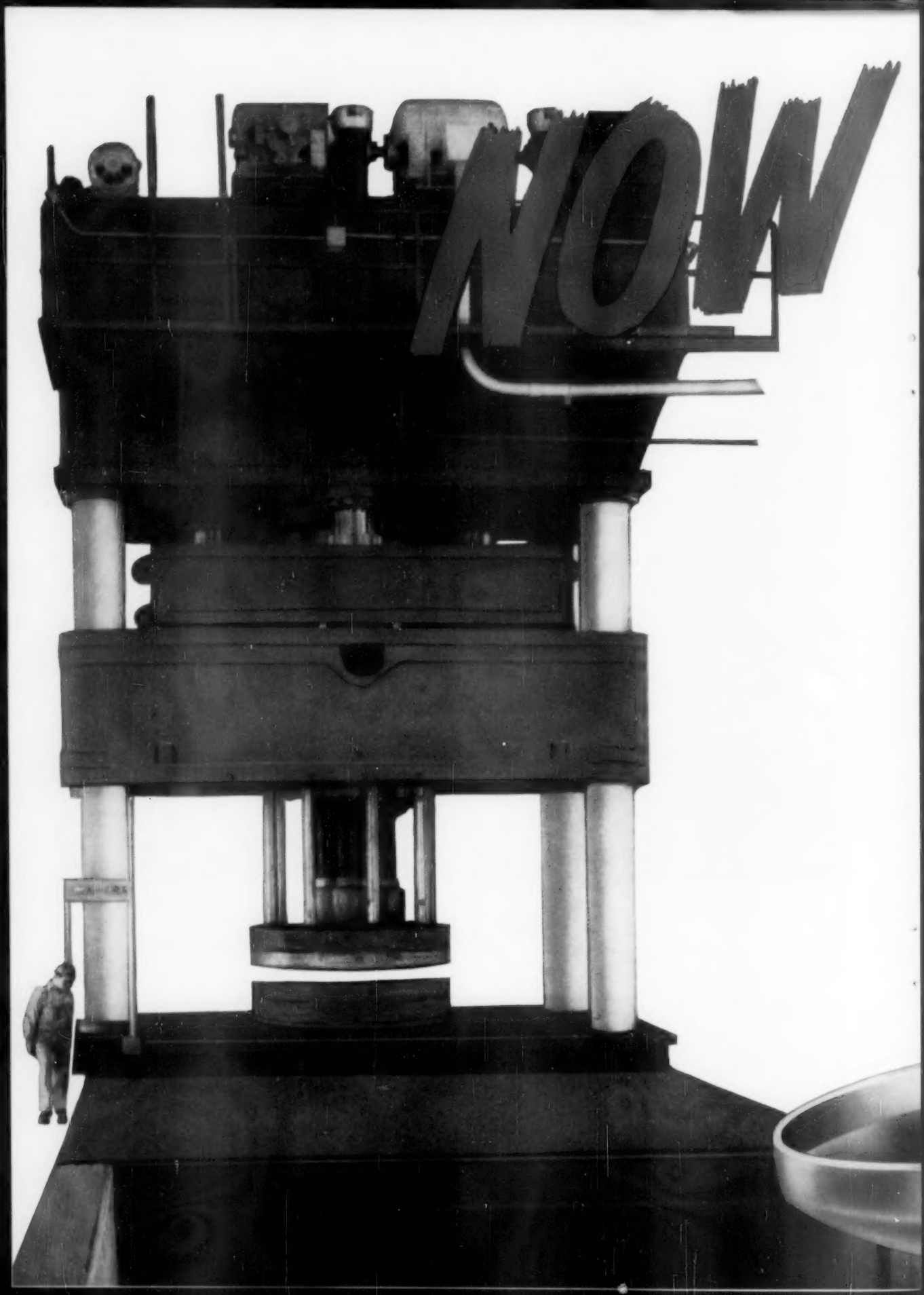
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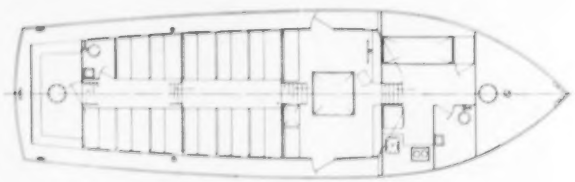

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Sunset area, 10 miles south of Opelousas, in southern St. Landry Parish.

Testing from perforations at 10,388-92 ft., the well, 1 Horaist, is reported to have flowed at the rate of 3,000,000 cu. ft. of gas and 240 bbl. of 52°-gravity condensate per day. Flowing pressure gaged 3,500 psi.

Location is about 4 miles east of Shuteston field, and about the same distance northwest of Arnaudville field in St. Martin Parish.

Bourg Extension Well Opens New Pay Zone

Production of Bourg field, on the Terrebonne-Lafourche parish line, is being extended ¾ mile southwest with a new-pay discovery by Union Producing Co.

The new discovery well, 1 Matherne, testing sand interval at 11,124-27 ft., flowed at the rate of 6,369,00 cu. ft of gas per day with an ungaged volume of condensate. Flow was through ¼-in. choke under pressure of 4,348 psi. Shut-in pressure gaged 4,664 psi.

The well was drilled to 13,269 ft. and has casing run to 11,897 ft. No other wells in the field have been completed in its producing zone.

SOUTHWEST TEXAS

Bexar County Discovery Opens New Chalk Field

A new shallow-pay (Austin chalk) is being opened 10 miles east of Von Ormy, south of San Antonio, in Bexar County. Discovery well, 1 Prinz, drilled by O. N. Beer and associates, is reported to have 100 ft. of saturation in open hole at 1,135-54 ft.

While cleaning after acidizing, the well was flowing 70 per cent oil and 30 per cent acid water. No gage of flow had been taken. Flow through ½-in. choke was with pressure of 75 psi.

Hole is plugged back from drilled depth of 1,292 ft.

Navarro Well Indicated In Medina Wildcat Test

Indications of another Navarro producing area have been given in a wildcat test drilled by Theljohn Oil Co. 4 miles south of Natalia, in Medina County. Operators have run oil string to 1,400 ft., through the pay, to test. Location, at 1 Briscoe, in the James Schmerber Survey 51¼, north of Bear Creek field, also productive from Navarro sand.

Successful Wildcats

ALBERTA

Royalite-Gulf-Devon Leduc et al 7-1 Stony Plain, LSD 7, 1-52-26w4. Basal Cretaceous oil well. TD 4,450 ft.

SASKATCHEWAN

Imperial 4-25 Cayuga, LSD 4, 25-3-30w1. Mission Canyon oil well. TD 3,726 ft.

ARKANSAS

Lafayette County: W&W Drilling Co. 1 Boulware, 35-15s-23w. IPP 50 BOPD, Tokio 3,090-3,106 ft., 23°. TD 4,010 ft. (New pay discovery in Northeast Stamps field).

Miller County: Sinclair Oil & Gas Co. 1 Eaves, C SW SW NW, 3⅜ miles east of Fouke and 3⅜ miles south of Fouke field. IPP 23 BOPD, Hill-Rodessa 5,520-24 ft., 44.3°. TD 5,695 ft. (Discovery of East Fouke field).

COLORADO

Bent County: M. J. Stansbury 1 Cordes & Oberlander, C SW SW 21-21s-51w. IPF 50 BOPD, 440 M.c.f. of gas per day, Pennsylvanian discovery, new field. TD 5,544 ft.

Weld County: The California Co. 1 Priddy, C NW SW 23-8n-66w. IPP 317 BOPD, Permian Lyons discovery, new field. TD 9,257 ft. Lower Satanka.

ILLINOIS

Crawford County: B. Montgomery 1 Dart et al, SE SW NW 1-6n-14w. IPP 50 BOPD, McClosky 1,936-43 ft. TD 1,943 ft. (Extension well to main field).

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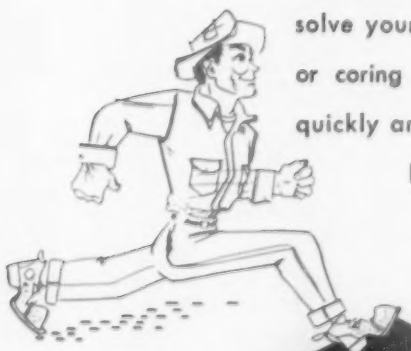

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TRUCO DIAMOND BITS AND D & S CORE BARRELS

"Oh, no—we couldn't be drillin' that crooked a hole!"

Washington County: Sun Oil Co. 1 Duerkob, SE SW SW 3-1s-4w. IPF 125 BOPD, Silurian 2,244-62 ft. TD 2,262 ft. (Opens North Okawville pool).

KANSAS

Kiowa County: Gulf Oil Corp. 1 Corse, NE NE SW 19-29s-18w. IP 10,000 M.c.f. of gas per day, Mississippian 4,956-64 ft., 4,972-90 ft. TD 5,050 ft. (Extension well in Nichols gas area).

Meade County: Colorado Oil & Gas Co. et al 1-3 Leslie, C SW NE 3-33s-30w. IPF 1,073 BOPD, Morrow sand 5,668-84 ft. TD 5,748 ft. (Opens Leslie field).

Carter Oil Co. 1 Adams Ranch, C SW NE 1-35s-29w. IP 2,109 M.c.f. of gas per day, Chester-Mississippian 6,076-6,106 ft. TD 6,175 ft. (Gas discovery—one of the state's deepest producers).

Pawnee County: Phillips Petroleum Co. 2 Guffey "A," SW NW NW 3-23s-15w. IPP 105 BOPD, Lansing lime, 3,668-3,732 ft. TD 4,021 ft. (Geological wildcat and new pay at Jay pool).

Reno County: Fleming & Woodman 1 Hilger-Cron, NE NE NE 30-26s-4w. IPF 25 BOPD, Misener sand 3,955-57 ft., 40.8°. TD 4,050 ft. (New pay and geological wildcat in Southwest Hilgers field.

Barber County: Trans Era Petroleum Co. 1 McCullough, NW NW NE 30-33s-12w. IP 1,600 M.c.f. of gas per day from Mississippian. Opens Southwest Boggs pool.

Lion Oil Co.-Gulf Oil Corp. 1 Brooks-Younger, SW NW NW 23-32s-13w. IP 41 BOPD, Mississippian. Opens Brooks-Younger pool.

Comanche County: Trans Era 1 Robinson, SE SE NE 5-31s-18w. Completing in Mississippian. Opens Mule Creek pool.

Graham County: Petroleum, Inc., 1 Billings, SW NW NW 25-10s-24w. Completing in Lansing. Opens West Dorman pool.

Empire Drilling Co. 1 Nichelson, SW SW NW 23-9s-24w. Completing in Lansing. Opens Glen Dale pool.

Trans Era-N. Appleman 1 Kurtz-Deitz, SE SE NW 8-10s-23w. IP 247 BOPD, Lansing discovery. Opens West Hoof pool.

Morton County: Musgrove Petroleum Co. 1 Jones, C SE NW 11-35s-43w. IP 2,579 M.c.f. of gas per day, Keyes sand. Opens Elkhart pool.

Pawnee County: Hams-Burt Drilling Co. 1 Spruill, NW NW SE 25-21s-16w. Completing in Arbuckle lime. Opens Southwest Sweeney pool.

Reno County: Globe Oil Co. 1 Hornbaker, SE NE NE 29-25s-6w. IP 141 BOPD, Misener sand. Opens Castleton pool.

Rice County: Brinrich Drilling Co. 1 Tobias, SE SW NW 22-20s-8w. IP 2,600 M.c.f. of gas per day, basal Penn. conglomerate. Opens Southwest Lyons pool.

Rooks County: Jones, Shelburne & Farmer 1 Sutor "D," SE NW NW 17-10s-20w. Completing in Arbuckle. Opens Southwest Amboy pool.

Stafford County: Oil Capitol 1 Ward, SW SW NE 11-23s-13w. Completing in Arbuckle. Opens Northeast Happy Valley pool.

LEGAL

SEALED BIDS FOR SALE OF OIL AND GAS ROYALTY INTERESTS on the Crow Indian Reservation, Montana, will be received in the Office of the Superintendent, Crow Agency, Montana, until 2:00 O'Clock (M.S.T.), WEDNESDAY AUGUST 10, 1955 at which time they will be opened and publicly read. Six (6) Units consisting of 80 and 120-acre tracts now under Oil and Gas Leases are involved. Sale of a "one-half (½) of a one-eighth (⅛)" interest in the Royalties in each case by individual allottees owning such mineral interest is being made. For further detailed information and a list of the lands and interests advertised call or write: L. C. Lippert, Supt., Crow Indian Agency, Crow Agency, Montana.

KENTUCKY

Henderson County: Styles 1 Willett, SW SE SW 19-P-21. IPP 40 BOPD, McClosky 2,571-75 ft. TD 2,708 ft. (Extension to South Smith Mills pool).

Muhlenberg County: Michigan Oil Co. 1 Baker, SW SW SE 11-H-30. IP 2,500 M.c.f. of gas per day, Jackson sand 565-80 ft. TD 1,047 ft. (Opens East Penrod pool).

SOUTH LOUISIANA

Allen Parish: H. L. Hunt 2-S Bel et al, 33-5s-4w. IP 111 BCPD and 2,500 M.c.f. daily, 7/32-in., 57°, perforations 9,866-72 ft. TD 9,920 ft. (New field.)

Plaquemines Parish: Continental Oil Co. 1 State Lease 2551, Block 84, West Delta area, Gulf of Mexico. IP 267 BOPD, 5/32-in., 36.1°, perforations 10,857-62 ft. TD 14,500 ft. (New field.)

NEBRASKA

Kimball County: Baird-Pfeifer Drilling Co. 1 Anderson-Forbes, C NW NW 6-12n-58 w. IPP 190 BOPD, "J" sand discovery, new field. TD 7,475 ft. Skull Creek. Opens Anderson-Forbes pool.

Empire Drilling Co. 1 Dolcater, SW SW NE 7-16n-56w. IPP 250 BOPD, "J" sand discovery, new field. TD 6,793 ft. "J" sand.

NORTHWEST NEW MEXICO

Rio Arriba County: Humble Oil & Refining Co. 1 Jicarilla "C", SW NE NE 4-23n-51w. IP 1,750 M.c.f. of gas per day, Pictured cliffs sand discovery, new field. TD 6,644 ft. Morrison.

San Juan County: El Paso Natural Gas Co. 1 Nelson, SW NE NE 8-26n-12w. IP 4,385 M.c.f. of gas per day, new pay, Gallup sand discovery. TD 5,420 ft. Mancos.

PENNSYLVANIA

Indiana County, Buffington Township: Felmont Oil Corp. 1 Marjorie Shankel, 200,000 cu. ft. gas. Tully 7,390 ft., Onondaga 8,177 ft., chert 8,230 ft., gas 8,234 ft., Oriskany sand 8,290-8,306 ft. TD 8,317 ft.

OKLAHOMA

Beaver County: United Producing Co. 1 Barby, C SE NW 34-5n-26eCM. IP 3,020 M.c.f. of gas per day, Morrow sand 6,785-99 ft. TD 7,150 ft. (Gas discovery).

Garvin County: Curry Drilling Co. 1 Brundage, SE NE NE SW 10-4n-3e. IPP 6 BOPD, sand 2,380-2,622 ft., 30.5°. TD 2,730 ft. (Oil discovery).

Hughes County: D&D Drilling Co. 1 McDonnell, 3 miles southeast of Round Prairie in SW SW SW 12-4n-9e. IPP 5 BOPD, Cromwell sand 5,218-30 ft., 33.6°. TD 5,300 ft. (Oil discovery).

Pontotoc County: Wm. H. Pine 1 Peterson, SE SE SW 22-4n-4e. IPP 26 BOPD, Bromide sand 1,412-40 ft., 38°. TD 1,440 ft. (Oil discovery).

TEXAS GULF COAST

DeWitt County: Coastal Trend Oil & Gas Co. 2 Pargmann, Antonio Lazo Sur., A-653. IP 6,000 M.c.f. daily, open-flow potential, 6 BC per M.M.c.f., 62°, perforations 4,074-76 ft. TD 4,076½ ft. (New field.)

Goliad County: Rock Hill Oil Co. and Sunray Mid-Continent Petroleum Co. 1 Els, Jose Maria Mancha Sur., A-203. IP 69.6 BOPD, 9/64-in., TP 125 psi., perforations 4,597-4,600 ft. TD 9,716 ft. (New field.)

Liberty County: Cron & Gracey 1 Martin et al, Williams Bloodgood Sur., A-3. IP 248 BOPD, 13/64-in., 40.5°, TP 550 psi., perforations 8,287-8,301 ft. TD 9,761 ft. (New pay in Esperson field.)

SOUTHWEST TEXAS

Atascosa County: Armstrong & Horn 5 Pruitt, J. Poitevent Sur. 11, A-694. IP 325.80 BOPD, 3/16-in., 34°, TP 1,150 psi. Austin chalk 6,203-12 ft. open hole). TD 6,212 ft. (New pay in Horn field.)

Dimmit County: Sutton Drilling Co. 1 Patterson, J. A. English Sur. 694, A-1522. IP 30 BOPD, ½-in., perforations 2,260-67 ft. (Olmos sand). TD 2,975 ft. (New field.)

Hidalgo County: George H. Coates 3-A Engleman Community, Lot 9, Block 69, Las Mestenas Grant. IP 2,000 M.c.f. daily, open-flow potential, perforations 6,567-91 ft. and 6,598-6,612 ft. TD 6,618 ft. (Extends San Salvador field.)

Jim Hogg County: Blair, Vreeland & Cotton 2 Strohman, Survey 299. IP 46.16 BOPD, 7/64-in., 32.7°, perforations 3,602-08 ft. TD 3,617 ft. (Discovery well Strohman field.)

Jim Wells County: H. R. Smith 2 Baker heirs, Teresa Bustillos Sur., A-62. IP 2,600 M.c.f. daily, open-flow potential, GLR 488 M.c.f. per barrel, perforations 3,110-16 ft. TD 5,613 ft. (New field.)

Kleberg County: Arkansas Fuel Oil Co. 1 May, Gabriel Trevino Sur., A-232. IP 182.08 BOPD, ¼-in., 32.8°, perforations 9,322-26 ft. TD 10,002 ft. (New field.)

WEST CENTRAL TEXAS

Callahan County: Midwest Oil Corp. 1 R. D. Williams, 7 miles northeast of Baird in Sec. 3, Blk. C, T&NO Survey, 1 mile east of production. IPP 73.50 BOPD, 34.1°, Crosscut sand 2,475-84.5 ft. (Oil extension well at Herr-King field).

Throckmorton County: Thompson-Powell-Derrick et al 3 J. S. Gilbert, 8 miles northeast of Woodson in Sec. 926, TE&L Survey. IPF 621 BOPD, 20/64-in. choke, 42.3°, GOR 981:1, perfs. in congl. 4,590-97 ft. TD 4,767 ft. (Oil discovery).

NORTH TEXAS

Archer County: W. A. Lofton 3-D Petrex, 8 miles southeast of Mankins in Lot 3, Blk. 114, ATNCL Subd. IPP 20 BOPD, open hole, top pay 1,308 ft., 39°. TD 1,310 ft. (Oil discovery).

Roy Rockwell 1 Turbeville, 9 miles west of Archer City in Blk. 49, Harris Subd. of Club Ranch. IPP 40 BOPD, 35°, top pay 1,168 ft., open hole. TD 1,175 ft. (Oil discovery).

Foard County: Lucerne Corp. 1 Maude E. Rasberry, 9 miles northwest of Crowell in Sec. 26, Blk. A, SPRR Sur. IPF 142 BOPD, caddo lime open hole, top pay 6,120 ft. 40.3°. TD 6,160 ft. (Oil discovery).

Grayson County: Wm. D. McBee 1 M. S. Hall, ½ mile northeast of Sherman in G. W. Glothlin Sur. A-827. IPF 168 BOPD, 12/64-in. choke, Simpson sand 9,932-52 ft., 40°, GOR 1770:1. TD 10,058 ft. (Oil discovery).

Young County: Warren Petroleum Corp. 2 Mavia Dent, 12 miles southwest of Newcastle in TE&L Sur. 2387, A-1104. IPP 68.40 BOPD, Caddo lime, open hole, top of pay 3,818 ft., 41.3°. GOR 638:1. TD 3,820 ft. (Oil discovery).

UTAH

Grand County: Cisco area: Cabeen Exploration Co. 1 State, C NE NE 36-20s-21e. IP 1,500 M.c.f. of gas per day, Dakota gas discovery, new field. TD 2,525 ft. Morrison.

WYOMING

Natrona County: Houston Oil Co. 1 Unit, C SE NW 6-35n-84w. IPP 105 BOPD, Tensleep discovery, new field. TD 4,952 ft. Amsden.

Veteran at 37

Postwar rise with Republic spices diversified career

CURTIS C. BOOK decided before he was awarded his petroleum engineering degree that a good working knowledge of the entire oil industry would be worth a lot to a man wanting to get somewhere in some particular aspect of the industry.

He's acted on that theory, and he's made it pay.

Book is now general superintendent of drilling and production for Republic Natural Gas Co., Dallas, a solid and relatively large oil and gas producing firm.

The energetic Republic superintendent is only 37.

Book was born in the oil patch at Sulphur, La., near Lake Charles. His father owned and operated F. A. Book Drilling Co. at El Dorado, Ark., where the younger Book was raised and received his precollege schooling. He was pumping water to one of his dad's drilling rigs when he was 10.

In 1934 he graduated from high school in El Dorado and worked 3 years, mostly in old Smackover field, at roustabouting, pumping, and pipelining for various independents. The last job he held before entering L. S. U. in 1937 was with Lion Oil Co. as a clerk in the general offices.

After obtaining his degree in 1941 as a petroleum engineer Book joined Tide Water Associated Oil Co., Inc., at Venice, La., down in the Mississippi delta "where the roads end." During his 1-year hitch with Tide Water, he learned a lot about barge drilling in the canals and bayous of the delta country.

He left Tide Water in a drastic switch in 1942 to join Root Petroleum Co. (now Pan-Am Southern Corp.) as a process engineer in a new refinery Root was beginning to build at El Dorado.

From petroleum engineer to process engineer at a refinery would seem an unlikely change to most people, but Book writes it off lightly.

"Since it was primarily a 100-octane avgas plant," he says, "its operations weren't as complicated as those at most refineries. Then, too, I was there while it was being built . . . purchasing, expediting, and checking design . . . and I learned a lot watching it go together."

Back to production . . . Book was transferred in 1944 to Root's newly formed production and pipeline department as petroleum engineer. He was at that time the only petroleum engineer in the department, which was established by Root when it decided that to operate at higher economic efficiency it would have to process some of its own oil.

Then to marketing . . . Book left Root in 1946 and joined the marketing department of Macmillan Petroleum Corp. in New Orleans as head of fuel-oil sales and merchandising in South Louisiana and Mississippi.

And production again . . . He joined Republic Natural a year later as petroleum engineer working out of Dallas. In his first job with Republic, he spent a year "trouble-shooting" on well completions in all of the company's operating areas.

He considers this period of his career as one of the most valuable, since it enabled him to become well acquainted with all company operations, nearly all of its employes, and most of its wells.

He was first promoted by Republic to district engineer at Pauls Valley, Okla., in 1947. He was named assistant district superintendent at Pauls Valley in 1949, then district superintendent there in 1950. He became assistant general superintendent of drilling and production at the Dallas headquarters in 1951 and last month was elevated to general superintendent.

Outdoor enthusiast . . . The Book family, which includes wife Mary, 14-year-old daughter Marilyn, and twin-8-year old sons, Larry and Gary, lives in the Walnut Hills area of Dallas.

The family, however, sees little of father during hunting, fishing, and golf seasons (which in North Texas just about take care of the year).

Book is a member of the American Petroleum Institute, Independent Petroleum Association of America, the Independent Natural Gas Association of America, the Engineers Club of Dallas, and the Mid-Continent Oil and Gas Association.

He served as chairman of the Golden Trend chapter of the A.P.I. production division in 1950-51.

Buck J. Miller has opened offices at Wichita Falls, Tex., as a consulting petroleum and geological engineer. Miller was at one time district engineer for The Texas Co. in the Wichita Falls area, and later was geological engineer for Russell Maguire, oil producer.

E. C. BROUN, JR.

E. C. (Ned) Broun, Jr., has been named assistant manager of Henderson Drilling Corp. of Houston. Broun was formerly a petroleum engineer with Humble Oil & Refining Co. and then chief petroleum engineer in the oil and gas division of Herman & George R. Brown, Houston. **Clive Runnells, Jr.** has been named a director of Henderson Drilling effective August 1.

C. M. Murray, Jr., has been appointed process engineer for Refinery Engineering Co., Tulsa. Murray was formerly sales and process engineer for Anderson-Pritchard Oil Corp., Oklahoma City.

Colman C. Casey has been named district manager of Monterey Oil Co.'s newly reorganized district office at Midland, Tex. Casey was formerly in Monterey's division office in San Antonio. **Howard E. Davis** has been named district geologist at Midland and **Bryant G. Head,** district superintendent of drilling and production.

Roy Ashcraft, drilling superintendent for Sapphire American Petroleums, Inc., Robinson, Ill., will occupy a like position with Calvin American, Inc., which has taken over Sapphire's drilling department and its oil-field operations in Illinois, Indiana, and Oklahoma. The following Sapphire supervisory personnel will continue in their present capacities: **C. Walton Brooks,** production

PERSONALS

superintendent; **Melvin F. Roberts,** division geologist; and **R. J. Moreland,** production supervisor for Oklahoma. **Robert Bulla** will be the new division engineer.

Fred L. Hoipkemeier has become production engineer for Texkan Oil Co. of Dallas. He formerly was junior petroleum engineer for Stanolind Oil & Gas Co. at Wink, Tex.

Ashby J. Badger has been named president of Utah Oil Refining Co. by the company's board of directors. Formerly the executive vice president, he succeeds **Edward S. Holt,** who is retiring as president but continuing as a director.

William R. Waag has accepted the position of petroleum engineer with the First National City Bank of New York. He was formerly a senior engineer with Sohio Petroleum Co. in Oklahoma City. Prior to that, he was associated with Plymouth Oil Co., Sinton, Tex.

Stanley G. Bendorf has opened offices as an independent petroleum consultant in Dallas. Formerly associated with Cities Service Gas Co. and Phillips Petroleum Co., Bendorf resigned recently from DeGolyer & MacNaughton of Dallas where he served as consultant in the preparation of engineering and valuation reports of oil and gas properties.

William H. Davison has become president and **Kenneth Davison,** vice president, of the recently formed Tekoil Corp. of Robinson, Ill. Tekoil is the successor to Davison Co., a petroleum engineering and producing firm specializing in secondary recovery. **Robert L. Shick,** former engineer of water flooding for Sohio Petroleum Co., will head the Tekoil engineering department.

John J. Carter, Humble Oil & Refining Co., formerly superintendent of the gas division, has been appointed manager of the gas and and gas-products department after recent reorganization of the company's gas division. **Frank G. Noble,** formerly assistant superintendent of the gas division in charge of engineering and construction, has been named chief gas engineer in charge of the gas-engineering division.

Sam Krasner, independent oil producer of Corpus Christi, Tex., has moved his offices to Dallas.

Lewis J. Bicking, Jr., Ashland Oil & Refining Co., has been transferred from Shreveport to Midland, Tex., as division production engineer. Bicking has been division engineer in Shreveport for the past 3 years.

John H. Trescot, Jr., has been appointed assistant manager of the oil department of Climax Molybdenum Co., New York, as the concern expands in water flood properties. Trescot was formerly connected with the pipeline department of Shell Oil Co.

Dean H. Mitchell, president of Northern Indiana Public Service Co., Hammond, Ind., has been nominated for the presidency of the American Gas Association for the 1955-56 term. Other nominees are **C. H. Zachry,** president of Southern Union Gas Co., Dallas, for first vice president; **A. W. Conover,** president of Equitable Gas Co., Pittsburgh, for second vice president; and **Vincent T. Miles,** treasurer of Long Island Lighting Co., Mineola, N. Y., for treasurer. Nominated for 2-year terms as directors are **M. A. Abernathy,** vice president of United Gas Pipe Line Co., Shreveport; **P. E. Beckman,** vice president of Pacific Gas & Electric Co., San Francisco; **R. E. Crawford,** president of Minnesota Valley Natural Gas Co., St. Peters, Minn.; **Lyle C. Harvey,** senior vice president of Carrier Corp., Syracuse, N. Y.; **John E. Heyke, Jr.,** president of Brooklyn Union Gas Co., Brooklyn; **D. E. Karn,** president of Consumers Power Co., Jackson, Mich.; **Wister H. Ligon,** president of Nashville Gas Co., Nashville; **Chester L. May,** senior vice president of Lone Star Gas Co., Dallas; **Robert W. Otto,** president of Laclede Gas Co., St. Louis, Mo.; **F. T. Parks,** vice president of Public Service Co. of Colorado, Denver; **J. C. Peterson,** president of Manufacturers Light & Heat Co., Pittsburgh; **W. F. Rockwell, Jr.,** president of Rockwell Manufacturing Co., Pittsburgh; **Edward H. Smoker,** president of United Gas Improvement Co., Philadelphia; **J. Theodore Wolfe,** executive vice president of Baltimore Gas & Electric Co., Baltimore; and **D. K. Yorath,** general manager of Northwestern Utilities, Ltd., Edmonton, Alta. Abernathy, Heyke, Karn, Ligon, Parks, and Wolfe are being renominated as directors of the association. Nominees will be voted upon at the 1955 annual convention in Los Angeles October 17-19.

John H. Jennings, manager of the petroleum department of the Colorado National Bank, Denver, has been appointed a bank vice president. Before becoming department manager last year, he had been associated with Deep Rock Oil Co., Sunray Oil Corp., Mountain Fuel Supply Co., and Ohio Oil Co.

Paul J. Moore, former consulting petroleum engineer in San Antonio, and **N. R. Field** of Miami, Fla., have formed Moore-Field Oil Corp. in San Antonio. The new corporation will operate primarily in the South Texas and Gulf Coast areas, where both partners presently have production.

R. M. Churchwell, division petroleum engineer for Ohio Oil Co. at Casper, Wyo., has been promoted to assistant chief petroleum engineer at Findlay, Ohio. He has been succeeded at Casper by **L. C. Powell,** formerly division petroleum engineer at Terre Haute, Ind. **R. N. Ayars,** formerly assistant division petroleum engineer in Houston, has replaced Powell at Terre Haute.

Dale H. Voss, former president of Voss Oil Co., Newcastle, Wyo., has been elected chairman of the board. His son, **Warren Voss,** has been named president, a director, and general manager of the company. **J. L. Minahan** of Fort Worth has been named chief geologist. **Richard E. Amidon** has joined the company as oil field engineer.

C. E. Reistle, Jr., president-elect of the American Institute of Mining, Metallurgical and Petroleum Engineers, has been elected vice president of Humble Oil & Refining Co. **Ralph J. Schilthuis** has been nominated for the Humble board of directors. Reistle joined Humble in 1936 as assistant chief petroleum engineer, having worked prior to that time as chairman of the East Texas Engineering Association. He became chief engineer in 1940, manager of the production department in 1945, and a director of the company in 1948. Schilthuis has had 25 years' service with Humble and was made assistant manager of the production department last year. He served as assistant head of the production division of the Petroleum Administration for War from 1941 to 1945.

PERSONALS

F. W. Popp, party chief for Stanolind Oil & Gas Co. in New Orleans, has been promoted to district geophysicist at Lake Charles, La. **Joe Fishback,** district geophysicist for Stanolind in Houston, has been transferred to the Boswell, N. M., district, and **C. J. Land,** district geophysicist at Roswell, has been moved to Midland, Tex.

James O. Trotter has been appointed manager of the crude-oil supply and transportation departments of Texas City Refining, Inc., Texas City. In this capacity he is responsible for the purchase of crude and the necessary components to supplement the refinery production, for the transportation of all products, and for general traffic matters. Trotter was formerly associated with American Republics Corp.

C. B. Smith, Jr., formerly assistant regional geophysicist for Continental Oil Co. in Denver, has succeeded **C. K. Shepherd** as regional geophysicist. Smith joined Conoco in 1946 and served on seismograph crews in Oklahoma and Texas before his promotion to division geophysicist at Casper, Wyo., in 1952. He has been assistant regional geophysicist in Denver since 1954.

Earl A. Trager, formerly senior geologist for the Federal Power Commission, has joined the geological and valuation department of H. Zinder & Associates, Inc., Houston, as chief geologist. **Thomas L. Kister,** formerly exploration geologist for The Texas Co., will serve Zinder & Associates as senior geologist, and **John D. Mullins,** formerly reservoir engineer with Union Sulphur & Oil Corp., will be senior petroleum engineer for the Houston partnership.

Jesse A. True, president of Sterling Oil of Oklahoma, Inc., has been named chairman of the board of Siboney Development & Exploration Co., subsidiary of Crescent Corp. and Sterling. Siboney was formed recently as a result of the parent firms' exploration program in Cuba. Other Siboney officers are **C. A. Houy,** vice president in charge of exploration and production for Crescent, president; **R. B. Hurlbutt,** chief geologist for Crescent, vice president; **O. O. Kerr,** secretary of Crescent, secretary; **W. F. Styler, Jr.,** vice president and treasurer of Crescent, treasurer; **Dr. Ernesto de Zaldo,** Havana attorney, assistant secretary; and **R. N. Tuggle** of Crescent, assistant treasurer.

Lamar Carnes, general counsel for Ada Oil Co., Houston, the past 2 years, has been promoted to vice president and general counsel.

Earl J. Cramer, production supervisor in the Midland, Tex., division of Standard Oil Co. of Texas, has retired after 46 years' service.

William R. Gray, geophysicist-geologist for Monterey Oil Co. in San Antonio, has resigned to open a consulting office there. Gray will specialize in oil and uranium surveys.

Tom Bolack, Farmington, N. M., oil producer, has become executive vice president and a director of Albuquerque Associated Oil Co., Albuquerque, following the firm's recent merger with Bolack Oil & Gas Co.

D. L. FERGUSON

Donald L. Ferguson, assistant manager of the East Coast manufacturing division of Esso Standard Oil Co., has been appointed chairman of the security committee of Standard Oil Co. (N. J.). He succeeds **Edwin H. Barlow,** who has retired. Ferguson, who will also retain his position in manufacturing, joined the Standard organization in 1920. In 1926 he became assistant superintendent of the Everett, Mass., refinery and in 1934 went to France to manage the Port Jerome refinery. He returned to the United States in 1938 as assistant superintendent of the Bayway refinery, Linden, N. J. He was made superintendent in 1940, assistant New Jersey plant manager in 1945, manager in 1946, and assistant manager of the East Coast manufacturing division in 1950.

Roy M. Mays, regional land superintendent for Continental Oil Co. in Denver, has been promoted to manager of exploration for Conoco's Rocky Mountain region. Mays succeeds **James Royds,** who has spent the past year in Egypt for Continental and who will return to an assignment in Houston. **Ben D. Donnell, Jr.,** formerly assistant regional land superintendent, has succeeded Mays as superintendent.

Victor H. Zoller, vice president and manager of the Midland, Tex., division of White Eagle Oil Co., has been transferred to Tulsa to supervise all White Eagle exploratory operations. Zoller opened the division offices at Midland last year. He will continue to direct operations of the division from Tulsa.

Otis Cooney, formerly division production superintendent for Continental Oil Co. in San Antonio, has been promoted to assistant manager of the company's southern region production department in Houston. **Robert E. White** has been promoted to assistant to the general management of Conoco's Rocky Mountain region with headquarters in Denver. White was formerly regional chief production clerk in Denver. **Fred L. Mace,** formerly assistant to the general management in Denver for Continental, has been appointed assistant to the general manager of Egyptian-American Oil Co., an affiliate of Conoco, in Cairo.

DEATHS

Everett H. Robertson, 55, chairman of the board of Suniland Oil Corp., died July 24 in Los Angeles. Robertson had lived in Los Angeles for about a year but also had homes in Fort Worth and at Palm Springs, Calif. Prior to 1947 he operated from Dallas as an independent operator and was for many years in partnership with George Etz in West Texas. He moved to Fort Worth in 1947 as president of Anton Oil Corp., which he dissolved in 1953 to form Suniland Oil.

J. F. McLaughlin, 66, long-time independent oil operator in North and East Texas, died July 24 in Mexia, Tex. McLaughlin entered the oil business at Archer City, Tex., in 1928 and operated rigs out of Wichita Falls for many years. He moved his headquarters to Mexia in 1947.

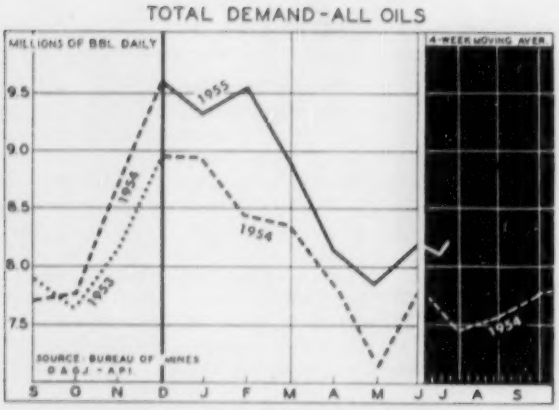
Robert G. Cole, 39, sales manager of Orbit Valve Co., died of a heart attack July 24 in Tulsa.

William J. Semple, 72, retired secretary-treasurer of Standard Oil Co. (Ohio), died recently in Cleveland. He had been in retirement since 1950. Semple was elected treasurer of Ohio Standard in 1931. Two years later he was elected a director and in 1935 became a vice president. He was named to the combined office of secretary-treasurer in 1939.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,647,350	UP	30,150	UP	403,030
Crude stocks	268,815,000	DOWN	1,675,000	DOWN	8,933,000
Completions	1,217	UP	185	UP	75
Refinery runs	7,620,000	UP	38,000	UP	846,000
Gasoline stocks	157,678,000	DOWN	1,144,000	DOWN	1,166,000
Distillate stocks	112,392,000	UP	3,460,000	UP	14,137,000
Residual stocks	45,260,000	DOWN	222,000	DOWN	8,325,000
Four-product stocks	346,536,000	UP	1,919,000	UP	4,783,000
Total imports	992,500	UP	21,100	DOWN	164,800



Inland Gasoline Prices Rise and Coastal Markets Strengthen

GASOLINE markets are improving in most areas of the country under the influence of high demands. Largest actual gains in spot prices have been on the inland markets.

Regular gasoline on the Group 3 market has moved up at least a cent a gallon since the end of the winter season. As late as March of this year some distress refinery gasoline was on the market at 10 cents a gallon. There were unconfirmed reports of sales at 9.75 cents when the normal market was considered to be about 10.25 cents.

The Group 3 market strengthened in the first half of April with the drying up of distress material. By the end of the third week of April, the price had moved up and stabilized at 10.75 cents. Some price quotations advanced to 11 cents but spot material continued to move at 0.25 cent under this posting until about the third week of July. Spot material now is selling at 11 cents.

Tank-wagon prices for both regular and premium grades are up in Colorado, Wyoming, Montana, Utah, and part of Idaho. Regular advanced 0.4 cent a gallon, and premium moved up 0.6 cent.

For many months the wholesale gasoline market in the Chicago area reflected the softness of the entire Mississippi River market. Group 3 refiners could not compete with river products on the Chicago market. Low prices on the river were based on subnormal prices on the Gulf Coast.

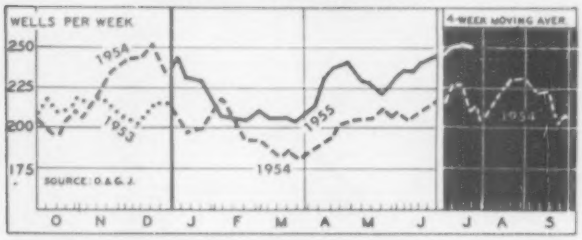
Gains in gasoline demand in recent months have taken some of the surplus gasoline from the Gulf Coast, resulting in a firming of the market. However, the river markets began to show signs of strength before the cargo market changed on the gulf. The end result of the added strength was an increase in tank-wagon prices in Chicago, the first in almost 2 years. The new posting raises gasoline 0.5 cent a gallon.

Gasoline stocks are low at most terminals along the Great Lakes pipeline. Some of the larger suppliers in the Mid-Continent are in the market for August gasoline, and most of them will need extra gasoline in September if demand reaches the expected level.

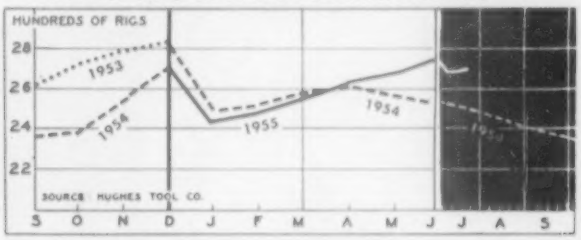
The attempt to end the gasoline price wars on the East Coast was not completely successful. In the second week of July, Socony Mobil Oil Co. announced reductions in tank-wagon prices for gasoline, and at the same time it eliminated all voluntary discounts in price-war areas. Other marketers met both the price reduction and the removal of discounts. Discounts in some areas amounted to as much as 5 cents a gallon. The action did not clear up all of the price wars, and recent reports indicate that dealer allowances are back in some areas. So far, these allowances have been held to about 1 cent a gallon.

Heavy-fuel outlook . . . Heavy-fuel markets are still very strong in all areas east of California. Increased world demand for resid is limiting the volume of material available for import. However, more material seems to be available on the Group 3 market than a month ago. Any reduction in steel production will lower the demand for low sulfur resid from inland areas.

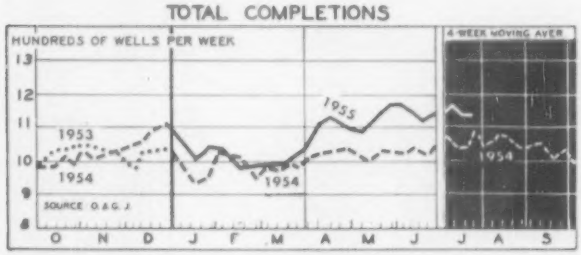
WILDCAT COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



TOTAL COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	7-25-55	Change from 7-18-55	Change from 7-26-54
Gulf Coast	585	— 1	41
N. and W. Texas-New Mexico	846	—17	96
Arkansas-N. Louisiana-E. Texas	165	12	7
Oklahoma	339	20	32
Kansas-S. Nebraska	179	8	15
Illinois-Eastern	136	—19	14
Rocky Mountain	300	10	44
Pacific Coast	144	0	23
Total United States	2,694	13	272
Western Canada	216	11	49

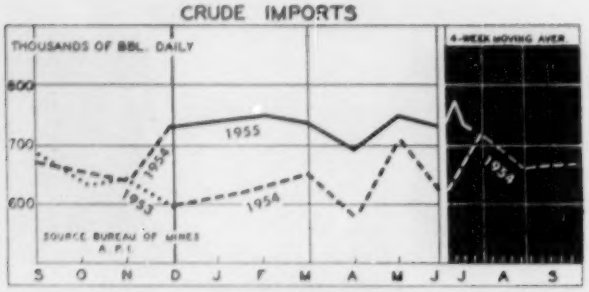
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 23, 1955

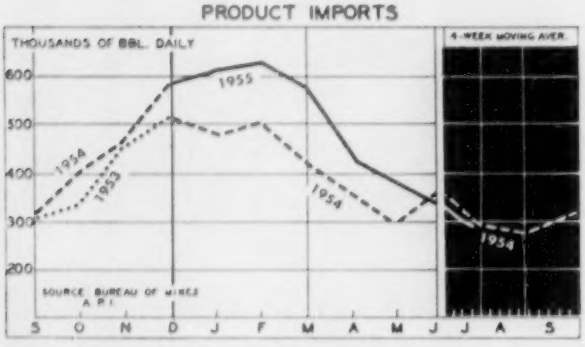
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	0	0	2	7,992	48	61	0	0	0	2	2	0	0	0	46	46
Arkansas	23	16	0	7	67,466	413	328	2	0	0	2	4	20	0	2	89	111
California	48	35	1	12	240,764	1,419	1,382	0	0	0	8	8	24	0	6	221	251
Colorado	35	7	4	24	175,800	778	738	2	0	0	19	21	26	0	17	397	440
Illinois	101	72	1	28	245,863	2,064	1,555	3	0	1	7	11	37	0	2	288	327
Indiana	6	1	0	5	11,939	411	457	0	0	0	3	3	8	0	0	172	180
Kansas	82	41	7	34	282,064	2,806	2,472	3	0	2	11	16	84	1	22	446	553
Kentucky	34	17	1	16	39,576	728	632	1	0	1	13	15	32	0	7	136	175
Louisiana	64	35	5	24	514,893	2,208	1,846	1	1	0	12	14	68	45	14	229	356
North	26	14	3	9	111,853	1,169	988	0	0	0	6	6	13	4	2	92	111
South	38	21	2	15	403,040	1,039	858	1	1	0	6	8	55	41	12	137	245
Michigan	14	7	1	6	41,146	285	304	0	0	0	4	4	6	0	0	107	113
Mississippi	5	3	0	2	36,757	267	217	0	0	0	2	2	12	0	0	92	104
Montana	8	5	0	3	36,021	172	159	0	0	0	3	3	5	0	1	50	56
Nebraska	25	7	0	18	148,413	424	198	2	0	0	12	14	24	0	0	176	200
New Mexico	44	16	24	4	176,634	900	619	0	0	2	2	4	20	1	8	70	99
Northwest	27	0	24	3	92,828	281	215	0	0	2	2	4	2	0	8	24	34
Southeast	17	16	0	1	83,806	619	404	0	0	0	0	0	18	1	0	46	65
North Dakota	3	1	0	2	21,037	130	151	0	0	0	1	1	1	0	0	24	25
Ohio	55	30	14	11	115,229	638	650	0	0	0	0	0	1	0	4	14	19
Oklahoma	182	118	12	*52	615,386	4,870	5,147	4	0	1	14	19	88	8	19	371	486
Pennsylvania-New York	25	6	9	†10	67,066	898	1,344	0	0	1	0	1	0	0	6	7	13
Texas	410	257	8	145	1,701,884	11,200	10,235	14	2	1	81	98	426	61	74	2,329	2,890
Southwest (1 & 4)	56	38	1	17	200,677	1,735	1,438	4	1	1	9	15	57	19	24	441	541
Gulf Coast (2 & 3)	42	22	0	20	263,024	1,415	1,477	2	1	0	15	18	51	33	25	364	473
East (5 & 6)	30	10	2	18	155,465	549	544	0	0	0	13	13	15	4	4	180	203
North Central (7-B & 9)	166	98	1	67	516,522	4,182	3,873	7	0	0	31	38	221	0	7	913	1,141
West (7-C & 8)	87	67	1	19	462,915	2,767	2,378	1	0	0	10	11	79	1	6	414	500
Panhandle (10)	29	22	3	4	103,281	552	525	0	0	0	3	3	3	4	8	17	32
Utah	6	1	1	4	20,443	44	36	1	0	1	3	5	4	0	3	26	33
West Virginia	18	7	8	3	38,772	341	312	0	0	0	0	0	0	0	8	10	18
Wyoming	25	15	1	9	133,496	437	770	1	0	0	5	6	13	0	5	95	113
Miscellaneous (Idaho)	2	0	1	1	5,896	19	83	0	0	1	1	2	0	0	1	14	15
Total United States	**1,217**	697	98	422	4,744,537	31,500	29,696	34	3	11	205	**253**	899	116	199	5,409	6,623
Total previous week	1,032	596	59	377	4,216,517			40	6	3	210	259	865	113	188	5,204	6,370
Total July 24, 1954	1,142	641	101	400	4,476,014			31	1	8	182	222	809	85	210	4,901	6,005
Western Canada	65	42	6	17	292,591												

Service wells included: *10, 16.

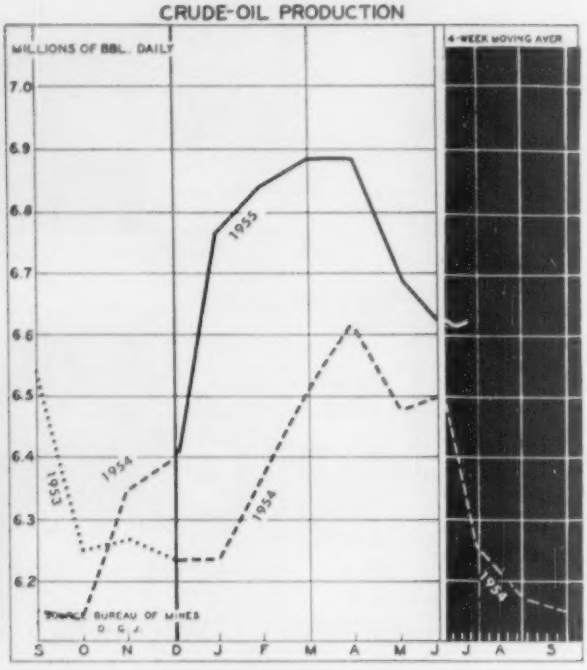
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

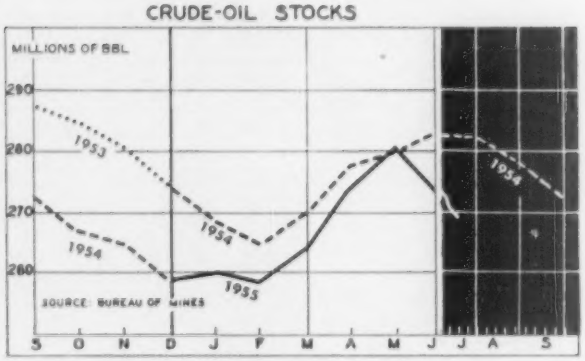


DAILY AVERAGE PRODUCTION FOR WEEK

	July 23 Crude oil	July 23 Lease condensate	July 23 Total	July 16 total
Alabama	3,500		3,500	3,400
Arkansas	73,350	450	73,800	74,650
California	977,200		977,200	975,200
Colorado	148,600		148,600	145,700
Eastern	49,800		49,800	49,800
Florida	1,325		1,325	1,325
Illinois	231,200		321,200	229,800
Indiana	30,000		30,200	27,900
Kansas	331,300		331,300	320,600
Kentucky	40,900		40,900	40,400
Louisiana	662,800	57,000	719,800	717,800
North	115,800	3,000	118,800	116,800
South	547,000	54,000	601,000	601,000
Michigan	33,900		33,900	31,300
Mississippi	96,200	3,925	100,125	100,125
Montana	45,600		45,600	45,100
Nebraska	29,900		29,900	29,600
New Mexico	224,700	3,400	228,100	228,300
North Dakota	29,700		29,700	29,400
Oklahoma	562,200		562,200	555,300
Texas	2,675,700	47,700	2,723,400	2,723,400
Dist. 1	48,000	475	48,475	48,475
Dist. 2	132,700	7,100	139,800	139,800
Dist. 3	418,000	23,000	441,000	441,000
Dist. 4	223,000	5,000	228,000	228,000
Dist. 5	47,200	425	47,625	47,625
Dist. 6	114,500	4,750	119,250	119,250
East Texas Field	202,000		202,000	202,000
Dist. 7-B	139,500	50	139,550	139,550
Dist. 7-C	170,000	4,300	174,300	174,300
Dist. 8	900,000	2,000	902,000	902,000
Dist. 9	191,000	450	191,450	191,450
Dist. 10	89,900	150	89,950	89,950
Utah	5,000		5,000	5,600
Wyoming	281,400		281,400	282,200
Others	‡400		‡400	300
Total U. S.	6,534,875	112,475	**6,647,350**	6,617,200
Change from prev. week, up			**30,150**	
Canada	†402,225		†402,225	†377,525
Total U. S. production January 1-July 23			1,369,666,500 bbl.	
Same period last year (crude plus cond.)			*1,311,621,805 bbl.	

*Includes 20,413,675 bbl. condensate. †Week ended previous Monday. ‡S.D. 100, Nev. 300.

CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

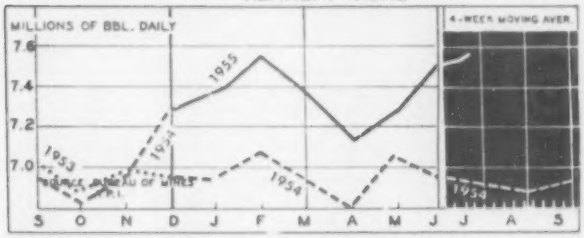
(Thousands of barrels)

	July 16, '55	July 9, '55	July 17, '54
Pennsylvania Grade	2,781	2,733	3,165
Other Appalachian	1,920	1,784	1,762
Illinois, Indiana, Michigan	11,027	11,419	13,015
Nebraska, North Dakota	1,822	1,623	(‡)
Kansas	7,986	7,700	9,465
Oklahoma	22,639	22,839	27,348
Arkansas	3,035	2,850	3,665
Louisiana	16,420	16,065	17,177
North	2,696	2,829	2,491
South	13,724	13,236	14,686
Mississippi	3,105	3,101	3,281
New Mexico	8,218	8,454	8,019
Texas	126,556	128,055	129,232
East Texas proper	9,855	9,743	12,100
West Texas	56,866	57,200	54,689
Texas Gulf	25,691	25,538	28,372
Other Texas	34,144	35,574	34,071
Wyoming	15,216	15,265	13,444
Other Rocky Mountain	5,393	5,528	5,295
California	31,029	30,904	31,877
Foreign	†11,668	12,170	11,003
Total	268,815	270,490	277,748

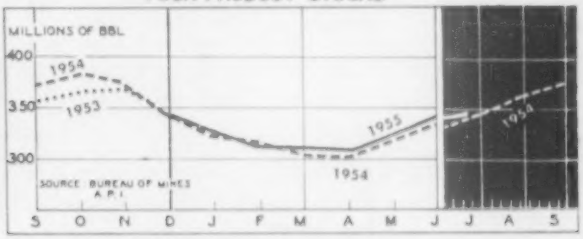
*Bureau of Mines. †Includes 2,627,000 bbl. in California. ‡Included with Kansas.

CURRENT DATA ON RUNS AND PRODUCTION ARE 4-WEEK AVERAGES

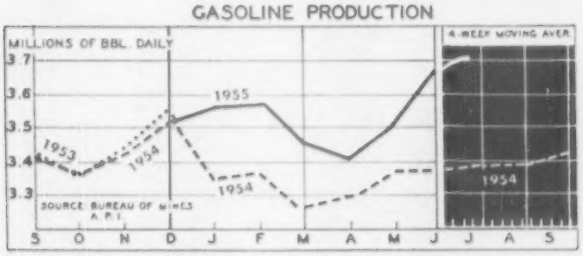
REFINERY RUNS



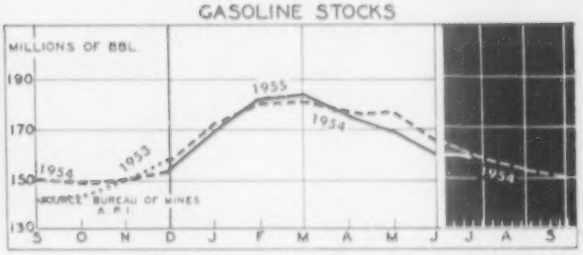
FOUR-PRODUCT STOCKS



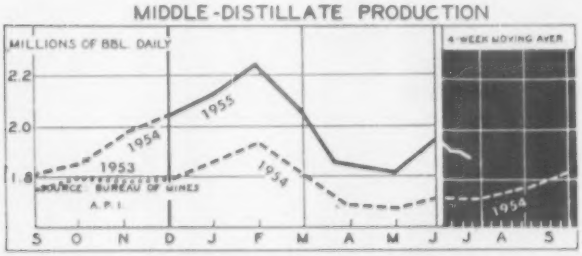
GASOLINE PRODUCTION



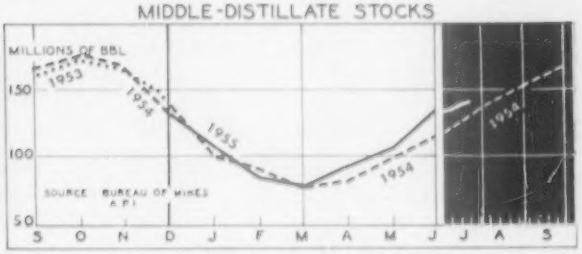
GASOLINE STOCKS



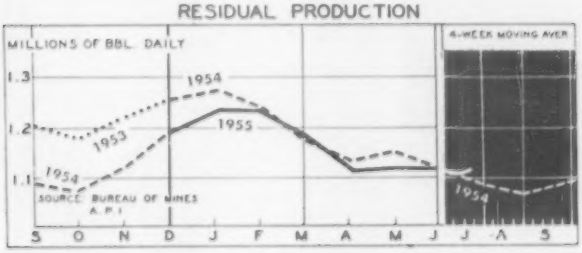
MIDDLE-DISTILLATE PRODUCTION



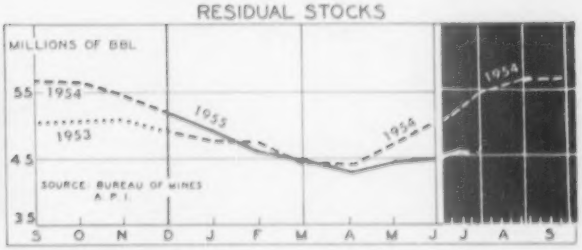
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



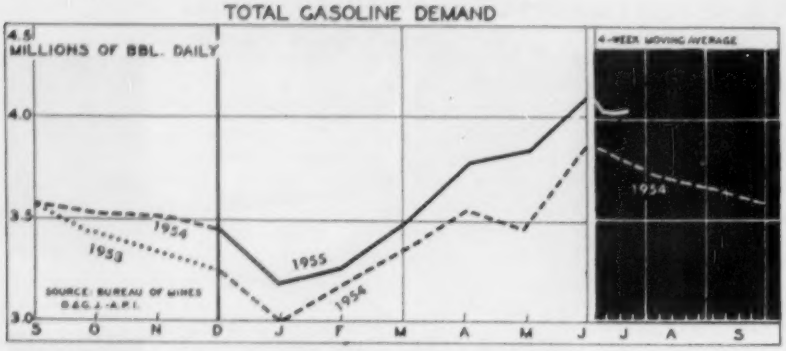
A.P.I. REFINERY REPORT, JULY 22

(Thousands of barrels)

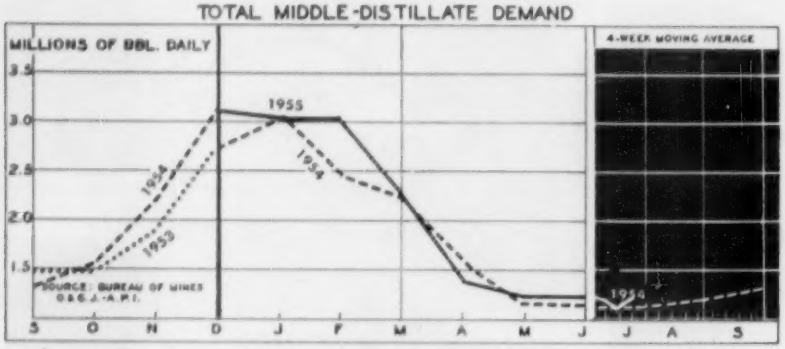
District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks† Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1954 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,122	436.3	27.8	262.7	200.9	36,525	12,525	37,778	10,751	1,073	441.0	29.9	241.9	210.9
Appalachian:														
District 1	101	44.1	4.6	21.7	3.1	3,987	514	2,601	337	100	43.9	5.1	20.5	5.5
District 2	101	57.3	5.3	17.0	14.3	2,358	523	889	349	89	48.6	2.2	13.2	10.5
Ind., Ill., Ky.	1,439	769.6	64.1	262.0	167.7	33,645	7,906	22,080	5,002	1,294	696.3	74.0	240.0	157.6
Okla., Kans., Mo.	664	386.4	14.9	157.4	37.0	14,765	1,996	12,685	1,134	600	342.5	14.6	135.2	32.8
Inland Texas	268	186.8	10.0	48.7	22.6	6,136	368	2,111	1,273	232	171.2	9.7	38.0	26.6
Texas Gulf Coast	1,816	882.6	79.0	396.7	255.8	20,384	3,877	13,469	5,080	1,595	790.4	94.5	370.6	213.1
La. Gulf Coast	600	279.6	47.3	141.0	35.1	9,320	1,796	5,289	1,570	565	264.2	54.2	135.2	41.3
N. La. and Ark.	90	26.1	11.0	21.9	4.9	3,660	1,000	2,071	64	90	34.6	7.5	21.2	6.3
Rocky Mountain:														
New Mexico	21	12.0	0.3	3.0	2.9	216	5	96	30	20	11.3	0.3	3.9	2.9
Other Rocky Mtn.	278	132.0	3.1	68.6	36.3	6,565	366	2,508	798	250	116.3	1.4	58.1	30.8
California	1,120	496.3	7.0	152.3	341.8	20,117	330	10,815	18,872	1,008	424.2	1.9	138.1	350.4
July 22, 1955	7,620	3,709.1	274.4	1,553.0	1,122.4	157,678	31,206	112,392	45,260	6,916	3,384.5	295.3	1,415.9	1,088.7
July 15, 1955	7,582	3,675.1	279.3	1,595.3	1,165.1	158,822	31,381	108,932	45,482					
July 23, 1954	6,774	3,366.4	272.9	1,408.0	1,075.0	158,844	31,069	98,255	53,585					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

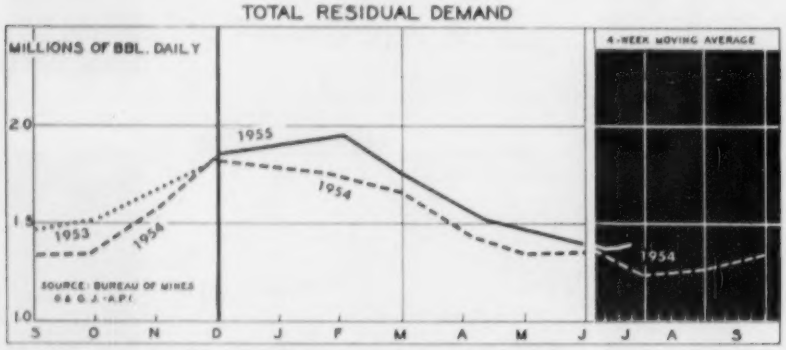
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of July 27, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	11-11.25	11.5-12	10.5-10.75
Premium gasoline	12.25-12.5	13-13.75	12-12.25
42-44 w.w. kerosine	9.25-9.50	10.05	8.5-8.75
No. 2 straw fuel oil	8.25-8.50	9.3	8.0-8.25
No. 6 residual	$1.75-1.85	$2.50-2.70	$2.10-2.25

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.0	4.5	4.75
Grade 18-55	6.0	5.5	5.75

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• Group 3 gasoline moved up 0.25 cent a gallon under the influence of continuing high demand. Tank-wagon prices for gasoline increased in Chicago and in the Rocky Mountain area. Gasoline is stronger on the Gulf Coast. Gasoline suppliers in New Jersey are allowing discounts to dealers in price-war areas.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 7-22-55	3,709	4,058
April 1955	3,502	3,786
June 1954	3,379	3,894
July 1954	3,384	3,723
Middle distillate:		
Four weeks ended 7-22-55	1,877	1,242
April 1955	1,847	1,489
June 1954	1,705	1,151
July 1954	1,711	1,105
Residual fuel:		
Four weeks ended 7-22-55	1,120	1,399
April 1955	1,100	1,553
June 1954	1,123	1,339
July 1954	1,089	1,226

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Sour. Includes New Mexico Permian.

Effective dates: California, February 16, 1953; east of California, June 15, 1953; Pennsylvania Grade, July 11, 1955.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.60
Middle District	3.47
Southwest Pennsylvania	3.18
West Virginia	3.07
Buckeye Grade	3.01
Zanesville Grade	2.82
Illinois Basin	2.90

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FOR SALE EQUIPMENT

WHEATLEY-TRIPLEX PUMP, FW-3108 5¾" x 8" stroke. Powered with 6DH-1879 Buda Diesel Engine—excellent condition. Degen Pipe & Supply, Tulsa.

FOR SALE—Three producing wells, tank battery, salt water disposal system, all good jacks and equipment, pipe line connection, priced to sell—The SW¼—Section 24—Township 15 South—Range 14 West—Russell County, Kansas. Contact the G & K Drilling Company of El Dorado, Kansas. Post Office Box 547 or Phone 392.

A "DOODLEBUG TO END ALL DOODLEBUGS"

Scientific—Accurate—Easy to learn. Mechanical—Magnetic. Equipment weighs from 25 to 50 Lbs. Can be used anywhere. Your insurance against loss. Information—

GEOLOGIST . . .
520-23rd St., Ashland, Ky.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

USED EQUIPMENT

#517—O.C.S. Type 3 Single Drum Unit, with Friction Clutch and Mechanical Controls. Mounted upon 1942 Model LF Mack Truck with 11:00 x 24 tires. No mast or Supports. Good Running Condition FOB Odessa $1,497.44.

#525—Model 50/60 Ideco Unit Powered by BLD 525 Buda Engine, Butane equipped with 250 Gallon Tank. 5 x 7 x 55' Double Pole Mast. Mounted upon 1945 KB6 Tandem International Truck. Complete Unit in fair condition FOB Tulsa $6,800.00.

#531—Cardwell Model KL Double Drum Skid Spudder, Jaw Clutch, Mechanical Controls. Power Model GF-638 Buda Engine, Operates on Butane. 60' Derrick, Three-Sheave Crown, Cable Raised. Unit in workable condition. Engine in pretty fair shape. FOB Seminole $3,875.00.

#536—Franks Model ET-DC Single Drum Well Servicing Unit. Serial No. 301, with 8 x 10 x 62-ft. Single Pole Mast, Tw-Sheave Crown, Cross Sheave, Stinger and Block. Mounted upon International Truck 1941, Model K-8-F, with 450 engine, butane equipped and has two 135-gallon tanks side mounted. FOB Tulsa $7,298.85.

#540—Cooper Model UM Single Drum shop made Winch, Powered by Good VIKU Waukesha with V-Belt Driven Jackshaft. Unit Mounted upon 1950 Model 180 International Single Axle Truck Capable of 4000 foot Well Servicing. No Pole Mast. FOB Tulsa $2,500.00.

#541—Franks ET Serial 222, with 8 x 10 x 62-ft. Single Pole Mast, Divider, Grooved Jacket, Cathead, Mounted on 1948 Model K8 International Truck. Steam Cleaned, painted and adjusted in good serviceable condition. FOB Tulsa $6,210.00.

Write, Wire or Call

FRANKS MFG. CORPORATION
DIVISION OF CABOT SHOPS, INC.
BOX 1218, WHITTER STATION
TULSA, OKLAHOMA

FOR SALE EQUIPMENT

RESHOPPED Fairbanks-Morse ZC 346 and 503, Continental 66 and 96 engines complete with clutches and accessories. Nolan Sales Corp., 421 N. Cincinnati, Tulsa, Okla.

FOR SALE: ENGINE—165 Hp. Climax Model R61, maximum continuous Hp. rating 126. Herndon Drilling Company, 421 Mayo Building, Tulsa. Phone GIbson 7-9700.

1—OIL WELL GBLU-125 Compressor Unit with 6½ x 13 TB Single Stage Compressor complete with 6 cylinder Waukesha Motor. Unit has an intake of 100# with a discharge of 600#. The above unit was used less than thirty days and can be purchased at a nice reduction. Wire, write or phone Louisiana Iron & Supply Company, Shreveport, Louisiana.

LIQUIDATION

COMPRESSOR STATION

6—600 HP IR Type KVG Gas Engine Driven 2 Stage Compressors.

$50,000 New Spare Parts for Above.

2—IR Starting Air Compressors, Model 25C, Type 40, 265#, 67.6 cfm.

TOWERS - COLUMNS

1—7'6" x 65'6", 30 trays, 45# psi.
1—7' x 25'6", 10 trays, 347 S/S, 50# psi.
1—6' x 58' x ½" Chrome-lined, 21 Trays.
1—6'6" x 65' x ⅝", 17 Chrome Decks, 9 Chrome Baffles.
1—6' x 27', 14 trays.
1—5' x 27' x ⅜" Shell, 10 Trays.
1—3'6" x 49' x ⅞" Shell, 28 Trays, 180#.
1—30" x 34'10" x ¼" Shell, 18 Trays.

TANKS - VESSELS

6—1250, 1,000 Bbl. Welded and Bolted.
10—8' x 15', 10' x 20', 6' x 20', 5'3" x 38'6", (Ch. Lin. 90#); 3'10" x 38', (325# 950° F), 7' x 15', 5' x 18'.

HEAT EXCHANGERS

3—Kellogg 2400 sq. ft. Admiralty, 150# psi.
1—Efco Steel Tube 1500 sq. ft., 150# psi.
1—Griscom Russell Admiralty, 742 sq. ft., 150# psi.
3—Struthers-Wells Admiralty, 425 sq. ft., 150# psi.

ATMOSPHERIC HEAT EXCHANGERS

8—715 sq. ft., 850 psig, 550° F., S/S.
6—470 sq. ft., 850 psig, 550° F., S/S.
13—715 sq. ft. 125 psig, 300° F., S/S.
8—715 sq. ft. Admiralty 125 psig, 300° F.

MISCELLANEOUS

1—Lab Petrochem Isoflow Furnace 50,000 BTU/hr.
1—B.J. Hot Oil Pump 3" x 9", 14 stage, 325 gpm, 4620' head, 11-13 nickel chrome impeller, 400 HP st. turbine.
1—Gould 4" Pump 300 HP, 3550 rpm, 400 gpm at 600' hd.

Partial List Only

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BRILL EQUIPMENT COMPANY

4101 San Jacinto St., Houston 4, Texas, JA 6-1351
Or
2401 Third Ave., New York 51, N. Y., CYpress 2-5703

FOR SALE EQUIPMENT

FOR SALE—1 type 80 Cooper Direct Gas Engine Driven Compressor entirely rebuilt. 2 same as is, or will rebuild to suit customer. Compressor Cylinders. All sizes. W. S. Smith, Tulsa, Okla., 205 Thompson Bldg., Tel LU 2-5473.

FOR SALE—One Mayhew 2000 drilling rig with dog house, drill pipe, misc. tools & equipment. Ready to go to work. Priced to sell. Contact G & K Drilling Company of El Dorado, Kansas. Post Office Box #547 or Phone 392.

FOR SALE: 1—Beaird—Ingersoll-Rand packaged Compressor Plant, Type 6-JVG (165 H.P.) Heavy-Duty, direct connected, 4-cycle, gas engine driven, single stage equipped with 3—4¼ x 9 compressor cylinders, three hand operated fixed volume pockets, two hand operated valve lifters, 20" O.D. 500# W.P. intake scrubber, air starting equipment and controls for automatic operation. Designed for intake pressure range 100#-250#, discharge pressure range 500#-600#. Delivery 3,480 MCF per day at 250# intake, 550# discharge. This plant has been in use less than 30 days and is located near Palestine, Texas. Box H-616, The Oil and Gas Journal, Tulsa, Oklahoma.

Gasoline Plant Equipment For Sale

3—800# 20 MMCF Absorbers with Scrubbers, etc.
2—150 HP 350# WP Lucey Oil Country Boilers Complete with Stacks, etc., and Steel Building.
1—30"x62' Depropanizer with Accumulator, Reboiler and Condenser.
1—36"x50' Stabilizer with Reboiler.
1—12"x40' Demethanizer with condenser and Reboiler.
1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.

Other Equipment, Instruments, Pumps, Pipe, Valves and Fittings necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Phone FAnnin 8103
Fort Worth, Texas

10,000 feet—16" O.D.
NEW ELECTRIC WELD

PIPE

¼" Wall — 42.05 lbs.
Double Random Lengths—
Plain ends.

IMMEDIATE SHIPMENT
Subject to Prior Sale

Phone—Write or Wire

BROWN-STRAUSS Corporation

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CORE DRILLS, SPUDDERS, ROTARIES: New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

REFINERY LIQUIDATION

POCATELLO, IDAHO

TOWERS

4'x59' 23 trays, 160 PSI.
7'6"x41'7" Reactor, 160 PSI.
4'6"x40' 13 trays, 180 PSI.
2'x47' 20 trays, 200 PSI.
2'x47' 20 trays, 375 PSI.
3'x49' 28 trays, 425 PSI.
2'x37' 16 trays, 250 PSI.
5'x36' Scrubber, 240 PSI.

FURNACES

Crude Oil, 18x20x13 (2), with chrome tubes.
Aux. Superheater, 5'x16'x12'.
Light Oil Cracker, 7'x13'x12'.
Vacuum, 13'x17'x23'.

HEAT EXCHANGERS

Steel Tubes, 94 to 550 sq. ft. (5)
Adm. Tubes, 140 to 440 sq. ft. (7)

PUMPS

HOT OIL
TRANSFER
CENTRIFUGAL

COMPRESSORS

170 to 300 CFM Elec. & Steam.
1406 SCFM Gas Driven.

LOADING RACKS

28 Car Railroad.
8 Car Railroad.
3 Truck.
2 Truck.

STEEL BUILDINGS

(11) from 150 sq. ft. to 2500 sq. ft.

BOILERS

3—153 HP 160 PSI Water Tube.
1—250 HP 150 PSI Stirling.

ETHYL BLENDING PLANT

Complete Unit.

METERS & CONTROLS

Quantity—All Types.

PIPE, VALVES & FITTINGS

½" to 12" Welded and Seamless.

STORAGE TANKS

(45) from 500 to 35,000 bbl. ALL WELDED

WRITE FOR COMPLETE INVENTORY

(At Other Locations)

DIESEL GENERATOR SETS

3—Busch-Sulzer 3060 HP, 240 RPM Diesel Engines, direct coupled to 3—2700 KVA E.M.C. Alternators, 3/60/2300/4160, with all accessories.

BOILERS

(3) Kewanee Firebox Boilers, 304 HP, 125 PSI WP, Series 500, Model 590. ASME & Natl. Board Stamped. New 1942.
(3) 153 HP Union Iron Works, 160 PSI, Bent Tube ASME, oil burners.
(1) 250 HP B. & W. Stirling, 150 PSI, ASME, comb. gas & oil burners.
(2) 4'x135' Steel Stacks.

Heat & Power Co., Inc.

60 East 42 Street — New York 17, N. Y. — Murray Hill 7-5280
310 Thompson Bldg. — Tulsa 3, Okla. — Diamond 3-4890

FOR SALE—At Oil Hill, Kansas, 4—Cooper Type 80 Twin Engine Compressor Units, with 8½"x20" Class A and 15½"x20" Class C Compressor Cylinders. Also 1—Type 80 Single DO, with 6½" and 10½" x 20" Tandem Cylinders. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE—Model M-6-WE. L. I. Heavy Duty Portable Shot hole or Water Well drill, mounted on 1952 F-8 Ford truck with new motor. 30' mast, 20' 3 5/16" Round Kelly. Possible to set 6" pipe through rotary table. This unit has just been completely overhauled. Price $8,500. Ray Hudgens, Box 2453, Midland, Texas.

FOR LEASE OR SALE

New Worthington Packaged Gas Compressor Units complete and skid mounted. Horse Power Range 50 to 300. Discharge Pressures to 1500 P.S.I.G. Buda or Waukesha Power Units.

KNIGHT MFG. & SUPPLY CO.

P. O. Box 3265 — Phone TEmple 8-2304
Tulsa, Oklahoma

SMALL GASOLINE PLANT—Sell all or any part absorption system, 5 million feet daily capacity. Two years old. Makes gasoline and LPG. The following compressor engine units are unitized and mounted on separate oil field skids and can be used for any purpose: Ingersoll-Rand 8XVG with 4 compression cylinders. Two Gardner-Denver RXE 14 x 7½ x 13 each with two compression cylinders powered by LeRoi L-3000's. Joy WNB-112, 10 x 7 V type 2 cylinder powered by Waukesha 6 LRO. Presently operating eight miles east of Comanche, Oklahoma. For sale by McNamar Boiler & Tank Co., Tulsa, Oklahoma. Phone Mr. Bolin at CHerry 6-6292.

FOR SALE NEW LINE PIPE

1,800 Ft. 30" O.D., .312 Wall, 99.08# Electric Weld Prime Grade X-52, Range 2 & 3, ends beveled. Located Mississippi and Tennessee.
18,700 Ft. 24" O.D., .281 Wall, 71.25# Electric Weld Prime Grade X-52, Range 3, ends beveled. Located Pennsylvania and New York.
1,000 Ft. 24" O.D., .312 Wall, 79.06# Electric Weld Sub-Standard, Range 3, ends beveled. Located Louisiana.
1,450 Ft. 14" O.D. .438 wall, 63.37# Limited Service Seamless, Range 3, beveled ends. Located Louisiana.
4,000 Ft. 3½" O.D. XH 10.25#, Prime Lapweld, Range 1, ends beveled. Located Louisiana.
1,850 Ft. 4½" O.D., XH 14.25#, Prime Lapweld, Range 3, ends beveled. Located Louisiana.

Priced Low, Prompt Shipment
Present Locations.

MID-STATES PIPE & SUPPLY CO.
Box 2534 — CHerry 2-9128 — Tulsa, Okla.

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$100,000.00 Inventory Drilling Tools
At 35% Off
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REED CORE KINGS
Cutter Heads and Core Catchers
Sizes from 5⅞" to 8½", both Hard and Soft formations for K-500 to K-675 barrels complete with K-36A 2 piece Core Catcher.

REED CUTTERS
(For Wire Line Coring)
Sizes from 7⅞" to 9⅞", both Hard and Soft formations, both Pin and Box connections for all type barrels.

H. C. SMITH, SECURITY AND REED ROLLER ROCK BITS
Sizes from 5⅞" to 9⅞", Soft, Medium and Hard formations. Includes some Jet Bits.
All materials guaranteed factory new, manufactured 1952. No leasing agreement required. Write for detailed list and prices.

B. E. Cowan & Associates
Box 328 — Elizabethtown, Kentucky

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply, Tulsa.

FOR SALE—at our Russell, Kansas warehouse. Three 40 HP OCS single crank BAT Pumping Units recently reclaimed from pumping wells. Price $1750.00 each. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE—At Oil Hill, Kansas one 3½" x 7" Aldrich Vertical Triplex Pump, Serial No. 15579. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

USED WINCHES AND SPUDDERS—Wilson Mogul single drum skid—Natchez, Mississippi. Wilson Senior single drum winch with mast—Olney, Illinois. Cooper E-36 single drum skid—Houston, Texas. Cooper UE double drum skid with rotary drive—Sourlake, Texas. Wilson Mogul double drum spudder unit with 70 ft. derrick—Blackwell, Oklahoma. For further information, call or write: Fred E. Cooper, Inc. Box 1899, Phone: CHerry 2-2194, Tulsa, Oklahoma.

SAVE MONEY

on
8" LINE PIPE
LAPWELD 8⅝" O.D. 28.55

Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.
Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi.
Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ½ cost of equivalent new pipe.
Will sell for cash or will finance meritorious propositions.

Brokers and agents protected.

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Phone 2-3276

PRESSURE VESSELS

Suitable: Coke Drums—Vacuum & Asphalt Units—Propane Tanks

13—10' ID Dia. x 40' long x 2½" to 3" Shell. Heads 3½" to 3". WP 600# and 500# PSI.

6—8' ID Dia. x 40' long x 2" to 2¼" Shell. Heads 2¼"—WP 500# PSI.

All used, excellent condition, code welded, manufactured by A. O. Smith. Priced near salvage value for prompt delivery East Chicago, Indiana.

Mid-States Pipe & Supply Co.

Box 2534, Ph. CHerry 2-9128, Tulsa, Okla.

USED REEL TRUCKS

Adaptable to Perforating or Swabbing Units

1950 GMC 1½ Ton Truck. Body Streamlined to cab. Reel can contain 18M Ft. 5/16" Amergraph Cable. Also measuring wheel.

1951 GMC 2 Ton Truck. Body as above. Reel hydraulically activated can contain 18M Ft. 5/16" wire line. Also measure meter and weight indicator.

1949 GMC 1½ Ton Truck. Box body behind cab. Reel can contain 15M Ft. 5/16" wire line. Mechanical level wind.

For Information

E. I. du Pont de Nemours & Company
320 Kennedy Building
Tulsa, Oklahoma
Phone LUther 4-6731

FOR SALE EQUIPMENT

TRAILER completely equipped, gas detectors, laboratory, bedroom, ideal for mud logging company, geologists, drilling contractors. Also new 2-way radio system. Trailer $1700. Radio system $1000. Call 18, Baird, Tex. Other completely equipped trailers available.

#12-PE 94' EMSCO Galvanized Bolted Type 437,000# capacity portable drilling mast with 7' high x 38' long pin type substructure. $8,800. Contact E. L. Lambert, Iverson Supply Company—Phone Davis 5-2836, Farmington, New Mexico.

TWO R. L. CARDWELL spudders complete with tools, dog houses, masts, light plants and etc., both working at present. These are not junk rigs. Must sell at sacrifice. Write 830 Bonita Street, Shawnee, Oklahoma, phone 496.

2—300 BBL. and 1—400 bbl. steel welded stock tanks, with stairs and walkway, 1—BS and B heater, 1—skid circulating Unit, all in excellent condition. LUther 4-4545, Tulsa, Okla., Box 1581.

FOR SALE: 1—Model RXC Gardner-Denver Packaged Compressor Size 8 x 9 #1664-70 and 1—4½ x 9 #166469 Compressor w/4 Feed Lubrication Mounted on steel skids w/ Cax Pump #303801 w/ Waukesha 6 WAKU of Unit w/ PTD Clutch w/ Megs Gas Starter w/ GARZA Lubricator w/ Happy VFF-26 Cooler, Gas Coil and Edlar 18 x 36 Scrubber w/ Trap Mercury Control Safety Valve, Belt Guards V Belt Drive. Bought new July 1, 1953. Good Condition. Located near Lafayette, Louisiana. Box H-944, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE
GOOD 5,000 FT. DRILLING RIG

1 Used Cardwell Model "S" Rig with Two WAK Engines and compound; 87' Lee C. Moore Jackknife Derrick with Substructure, Crown and Traveling Blocks, Hook and Rotary. Located at Liberty, Texas.

Contact **WILSON SUPPLY COMPANY**
P. O. Drawer 19 — Houston, Texas

EQUIPMENT WANTED

CARDWELL MODEL H double drum truck mounted machine in good condition, equipped for rotary workover. Send inventory and full details to Box H-949, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—Truck mounted rotary, 2500 feet minimum depth, also 2⅞, 3½ inch drill pipe. Middlefork Oil Co., Box 650, Great Falls, Mont.

WE BUY—for salvage abandoned wells, leases and pipe lines; Texas and Louisiana. PIPE Inc., Box 1965, phone TUlip 4-4029, Corpus Christi, Texas.

WANT TO PURCHASE two bubble towers, 30-40 trays, 18"-24" tray spacing, 5'-6' diameter, 50-150 pounds working pressure. Please advise best price and condition. Box 426, Irving, Texas.

ROTARY RIG complete ready to work, 3000 foot capacity. Please state price, location, make of components, condition and include inventory in first letter. Tools must be in A-1. Box H-939, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Quantities of 10¾" 8-V or 8 round thread #1 Grade Used Casing or Line Pipe Couplings and quantities of 7" 10-V thread #1 Grade Used Casing Couplings, also interested in buying used casing and tubing. THE BUCKEYE SUPPLY COMPANY, 18 Harrison Street, Zanesville, Ohio.

WANTED—One 200 hp. LeRoi Gas Engine, type H2000. W. Caplis, Box 1312, Shreveport, Louisiana.

GAS DRIVEN compressor, non-lubricated type. Capacity 6,000,000 to 10,000,000 SCFD, suction 500 PSIG, deliver at 650 PSIG. Also a Scotch Marine Boiler, 150 HP, 150# working pressure. Advise cost, location, condition and other details. Box 426, Irving, Texas.

HELP WANTED

OIL INDUSTRY Employment Service Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Oklahoma. Specializing in Engineers with oil-industry experience.

SEISMIC Party Chief for work in United States with degree in Geophysics, Geology, or Engineering, age 26 to 35, capable of advancing in small progressive contract seismograph company. Must be good interpreter. Salary commensurate with ability. Please include education and complete brief of experience in first reply. Replies confidential. Box H-932, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

EXPANDING INDEPENDENT Oil Company wants young geologist experienced in mapping and electric log interpretation (1 to 3 years experience). We want ideas for future drilling. Reply giving age, experience, and salary expected. Box H-904, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST of outstanding ability for strong independent oil company establishing district headquarters in New Orleans, La., for operations in Coastal Louisiana. Must have had at least seven years diversified subsurface experience in Louisiana and Upper Texas Gulf Coast and be able to evaluate a subsurface or seismograph prospect. Bacher degree minimum requirement. This is a position that requires initiative and enthusiasm for oil finding. Permanence of employment and opportunity for advancement are assured if expanded operation is successful. Attractive salary. Applicant should give complete background information, references, and salary expected. Replies strictly confidential. P. O. Box 432, Corpus Christi, Texas.

LOS ANGELES AREA—
PROCESS DESIGN
ENGINEERS

Must have degree in chemical engineering; minimum of five years experience in petroleum refinery design; capable of evaluating refinery operations and data, preparation of process calculations, process flow diagram and equipment specifications. Follow through on mechanical design of facilities. Will be expected to make independent analyses and exercise individual judgment. Please write to Chief Design Engineer and give full details of personal history and work experience. Provide references and include photograph.

GENERAL PETROLEUM
CORPORATION
A SOCONY MOBIL COMPANY
3700 West 190th Street
Torrance, California

REFINERY ENGINEERS
needed in
SOUTH AMERICA

Attractive staff positions are available with affiliates of Standard Oil Company (N.J.) for qualified experienced technical graduates.

MECHANICAL ENGINEERS—Must be thoroughly qualified and experienced design and/or maintenance of refinery or chemical plant equipment including piping, pressure vessels, heat exchangers.

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CHEMISTS—Assignments in control or development laboratory will include product quality control and/or investigations of problems of developing new products and processing methods.

Attractive salaries, liberal annuity and savings program offered.

Write, giving age, marital status, education and details of previous experience.

BOX 208-P.

Radio City Station
NEW YORK 19, N. Y.

HELP WANTED

ATTRACTIVE OPPORTUNITY for Process-Project Engineer with substantial Independent Gasoline Plant company in Gulf Coast Area with minimum 4-5 years experience in gasoline plant processing, design and economic studies. Experience with modern refinery processing, design and economic studies desirable. Furnish complete resume of personal history, experience and qualification which will be treated confidentially. Box H-942, The Oil and Gas Journal, Tulsa, Oklahoma.

RESEARCH ENGINEER

Major oil company has opening in production research for a man with petroleum engineering and/or geological background. Work involves research on core-analysis methods, fluid-flow, and related petroleum reservoir studies. Location, midwest. Applicant should supply complete resume of education, experience, qualifications, references and salary expected. All replies confidential.

Box H-926,
The Oil and Gas Journal,
Tulsa, Oklahoma

AREA ENGINEERS

Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

ARABIAN AMERICAN OIL COMPANY
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A decision to expand markedly drilling and production research activities at
THE RESEARCH CENTER OF
THE GULF OIL CORPORATION
creates excellent opportunities for
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APPLIED MATHEMATICS
PETROLEUM ENGINEERING
PHYSICAL CHEMISTRY
MECHANICAL ENGINEERING

Experience in the problems of production research or field operations while desirable is not essential.

- Liberal publication policy.
- Rural location 15 miles N.E. of Pittsburgh.
- Salary open.

Write to:

Gulf Research & Development Company
P. O. Drawer 2038
Pittsburgh 30, Pa.

HELP WANTED

YOUNG MAN with background in economics and marketing to do statistical and analytical work—independent oil refiner and marketer. Degree with major in marketing or economics essential. This presents good opportunity for right party. P. O. Box 3053, Dallas, Texas.

WANTED: Petroleum or Mechanical Engineer for designing oil field equipment. Excellent working conditions. Forty-hour week. Located in Dallas, Texas. Two years actual field experience desirable. Please give age, experience, education and salary expected. Box H-911, The Oil and Gas Journal, Tulsa, Oklahoma.

EXCELLENT OPPORTUNITY with independent oil company for GRADUATE PETROLEUM ENGINEER, under 35, at Midland, Texas. Must have three years' West Texas experience and be outstanding in field production problems, workovers, testing, drill stems and completions. Replies confidential. P. O. Box 3053, Dallas, Texas.

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FREEPORT, TEXAS

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Positions available for qualified candidates in Organic and Inorganic Research, Development, Organic and Inorganic Production, Process and Plant Design, and Analysis.

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Good Housing Conditions

Qualified applicants please submit resume and record of college work to:

D. M. Duguid

The Dow Chemical Company

Freeport, Texas

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

RESERVOIR ENGINEER, wanted by consulting engineering firm, with experience in estimating and valuing oil and gas reserves. Location Tulsa, Oklahoma. Please state age, experience, education, and salary requirements. Box H-947, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE Chemical Engineers with at least two years experience for positions open in Refinery operations located in Tulsa. State qualifications and salary expected. Write Personnel Department, P. O. Box 381, Tulsa, Oklahoma.

WANTED: By an independent oil company, a graduate Petroleum Engineer with varied experience in secondary recovery operations in the Tri-State area. Please give full particulars of experience and salary expected in the first reply. Box H-946, The Oil and Gas Journal, Tulsa, Oklahoma.

OPPORTUNITIES In Petroleum Sales

Expansion program provides real opportunities for life-long careers with well-known refining and marketing oil company. Prefer engineering or chemistry background together with experience in sales of gasolines, lubricants, naphthas or distillate fuels. Age 25 to 35, travel. Replies treated confidentially. Write

Deep Rock Oil Company
P. O. BOX 1051,
TULSA, OKLA.

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Attractive salary & other benefits. Excellent personnel development program. Opportunity to obtain additional experience. Openings now for men with up to 5 YEARS EXPERIENCE in drilling, production, reservoir & equipment.

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Immediate position for man with broad refinery accounting experience to act as Chief Accountant and Supervisor of all accounting and financial duties at refinery, and also to act as refinery Office Manager. Reply Air Mail giving complete resume including present salary, availability, etc.

Commonwealth Oil Refining Company, Inc.
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NEW YORK 17, NEW YORK

SITUATIONS WANTED

PETROLEUM ENGINEER, 10 years diversified production and management experience with major company and independent operators. Available for supervisory position with active organization. Box H-925, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM GEOLOGIST, 2 years West Texas, 4 years Oklahoma, major and independent experience, desires job with independent or individual in Oklahoma City. Box H-952, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER desires position with consulting firm or independent operator. Six years experience with major oil company, primarily water flooding. Box H-943, The Oil and Gas Journal, Tulsa, Oklahoma.

TITLE MAN long experience maintaining leasehold records, payment delay rentals, etc., desires connection small oil company or independent operator. Box H-920, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER—M.S. Degree and 4 years experience with major company in Secondary Recovery and Primary Development Programs desires position with advancement. Box H-941, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Geophysicist desires employment with active oil company in exploration department. 6 years experience including supervisory experience with contract geophysical firm. Box H-908, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED Petroleum Executive—College chemistry graduate, age 40, integrated independent background. Well qualified with extensive top-level refinery management, sales, transportation, and production experience. Earnings in excess of $18M annually. Want permanent position with growth opportunity. Box H-933, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-ENGINEER, thoroughly experienced in office and field procedure by 8 years of major and 8 years independent work in South Texas, Gulf Coast, Louisiana, Oklahoma, East & West Texas. Desire connection with active independent or individual. Box H-934, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 30, 6 yrs. drilling, production, administrative and evaluation experience in California oilfields. Desires position with aggressive independent or small expanding California organization. Phone DIckens 33880, Los Angeles or Box H-923, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—LATIN AMERICA

5 YEARS extensive experience in Latin Amer. Geology. BS Geology. 30 yrs. old, married, no children. Desires more Latin American work.

BOX H-938,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY
P. O. Box 1628, Hobbs, New Mexico
Phone 3-3141.
146 Allen Building, Midland, Texas.
Phone 2-2962.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

WANTED

PRODUCING or non-producing royalties or producing properties. Give description and price. Owners only. P. O. Box 1463, Tulsa, Oklahoma.

WANTED—Production and acreage to drill in Butler County, Kansas. Box H-950, The Oil and Gas Journal, Tulsa, Oklahoma.

CONNECTIONS WANTED with American firms for representation & sale in Italy of their own products in any branch of oil & gas field by specialized, fairly introduced supply shops owned by Orlando R. Rossi. Address: Via Tuscolana 670/672—ROME (Italy). Telegraph code: "TERMIDRA—ROMA."

LEASE AND DRILLING BLOCKS

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Investments.

SILICA SAND, excellent deep and shallow Oil potential, 141.56 acres, approximately 10,000 yards sand per acre. 15 miles South San Antonio, Texas. ½ mile off paved Hi-way. $200.00 per acre. Usual Royalty. Owner, C. M. Hazel, Devine, Texas.

FOR SALE—Eighty acre lease across from wildcat in Western Oklahoma. Only lease available. Surrounded by major companies. Take a chance before well comes in. Box H-951, The Oil and Gas Journal, Tulsa, Oklahoma.

SELL Colorado Ranch 30,000 Acres. Oil possibilities, $16.50 acre. OIL Lease blocks in E. Colo. URANIUM Deals S.W. Colo. See E. H. Grantham, Ordway, Colo.

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis, Mo.

OIL NEWS LETTER

Free on request. Includes map showing recent successful well completions, new field discoveries, etc. Also drilling wildcats & their progress, oil & gas fields, major lease holdings & factual news items regarding an area that offers you the chance of a life-time by filing oil & gas leases on U. S. govt. land.

OIL LEASE SERVICE, INC.
Bonded Lease Broker, Dept. OG,
8943 Wilshire Blvd., Beverly Hills, Calif.

ROYALTIES

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

NEW CUSTOMERS SOLICITED. You can now make very small investments on income Royalties or those ahead of Drilling. A. S. Berry, P. O. Box 1383, Tulsa, Okla.

FOR SALE: Oil Royalty under Sections 35, 26, 23, all in Twp. 1 N—Range 58 West, Morgan County, Colo. Four wells producing at present time. Write H. L. De Laney, South Star Route, Fort Morgan, Colo.

IN THE HEART of the Williston Basin: Landowners Royalties in major company blocks. Landowners Royalties Company, Box 1225, Great Falls, Montana.

JACK EAGLE, Oil Properties, 706 City Nat'l. Bldg., Oklahoma City, Oklahoma, Telephone REgent 6-7027.

STRIP LOG CABINETS

MORE LOGS ARE FILED in Kraftbilt Strip Log Cabinets than all others combined. Loaded drawers glide smoothly on roller bearings. Three drawers per section; add sections as needed. Built to last a lifetime! Send for new Catalog 1054-B, Ross-Martin Co., P. O. Box 800-A, Tulsa 1, Oklahoma.

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OFFICE SPACE AVAILABLE in McPherson Kansas About January 1, 1956—long lease. 9,000 Sq. ft. for rent. May be divided. Air Conditioned—Strictly Modern. Cross Roads of Nation—on Hi-Way 50 and Hi-Way 81. Inquire Farmers Alliance Mutual Insurance Co., McPherson, Kansas.

ELECTRIC LOG CABINETS

FOR ECONOMICAL FILING of full-size electric logs, most geologists prefer Kraftbilt E-24 4-drawer cabinet. Two compartments to each drawer with separate follow blocks make this cabinet handy, economical. For filing reduced electric logs, geologists use Kraftbilt E-28 8-drawer cabinet. Send for new Catalog 1054-B. Ross-Martin Co., P. O. Box 800-A, Tulsa 1, Oklahoma.

SCOUTING SERVICE

APPALACHIAN BASIN—Weekly scout reports, exploration and development: New York, Penna., & W. Va. For information write: H. & R. Scouting Service, Box 312, Coudersport, Pa.

BUSINESS OPPORTUNITIES

URANIUM CLAIMS for lease San Juan County, Utah. Excellent prospects in Chinle, Shinarump formations. Ready for immediate drilling. If desired, am qualified to act in supervisory capacity. Box H-953, The Oil and Gas Journal, Tulsa, Oklahoma.

PARTNER WANTED: I wish to form an association with some reliable individual Oil Operator or Drilling Contractor, who already has or can get good drilling prospects. I am in position to raise capital for promotional drilling. Exchange of references essential. Box H-945, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE OWNER of acreage over Gas and Oil seepages needs financing to drill shallow wells in Anderson County, Tennessee. Excellent structures. Gas markets nearby. Contact E. A. Munyan, 102 Fairview Drive, Fairfax, Va.

EXECUTIVE, Administrative Petroleum Geologist desires exclusive retainer agreement with group interested in buying proven oil and gas properties, drilling deals, leases, etc., or will aid in forming oil company in exchange for executive position and stock bonus. Box H-914, The Oil and Gas Journal, Tulsa, Oklahoma.

OPPORTUNITY to participate in drilling of oil wells on off-set acreage in Illinois. Address—Frederick—500 S. St. James Blvd., Evansville, Indiana.

DO YOU NEED financing to drill your deals? Active independent oil company needs shallow drilling deals to 3,500'. Will drill any deal our geologists recommend. For interviews, submit details to Box H-882, The Oil and Gas Journal, Tulsa, Oklahoma.

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Inspection made immediately.

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Amarillo, Texas

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LEGAL

SEALED BIDS will be received until 10:00 A.M. Tuesday, August 23, 1955, and opened at that time at the Cheyenne & Arapaho Sub Agency for the leasing of allotted and tribal Indian lands located in Custer and Washita Counties, Oklahoma, for oil and gas mining purposes. For additional information write or telephone Mr. Edzards, Area Field Representative, Cheyenne & Arapaho Sub Agency, Concho, Oklahoma, through El Reno, telephone 2238-W-1.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 391.13 acres of land in three parcels, within the known geologic structure of Wellington Field, in Larimer County, Colorado, and 316.80 acres, in one parcel, within the known geologic structure of the Lee Field, undefined, in Morgan County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p. m., M.S.T., August 25, 1955, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

National

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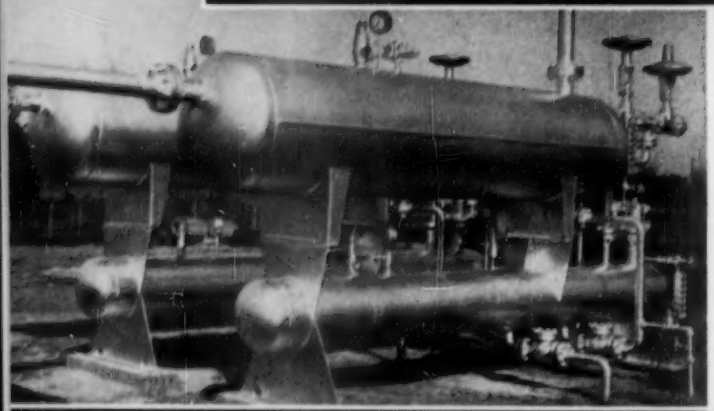
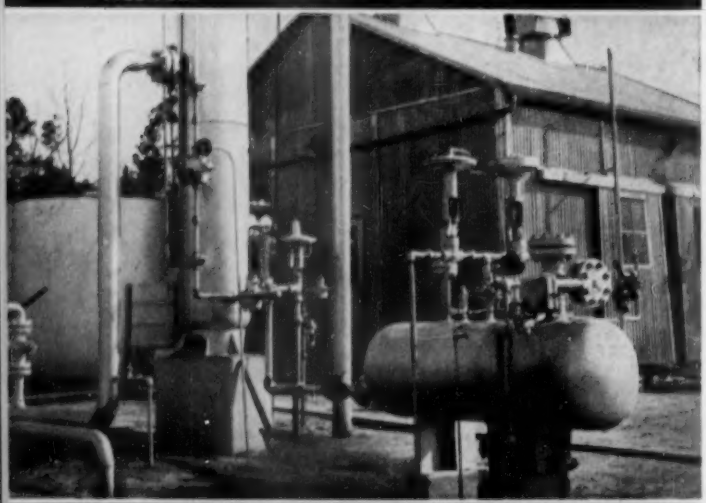


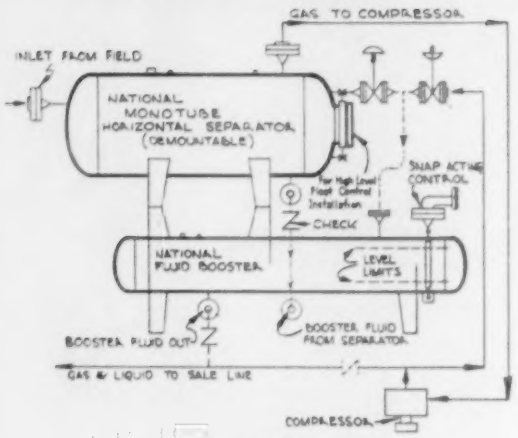
2—30" 500 PSI Oil and Gas Separators with 16" 1200 PSI BOOSTERS. Compressing gas at this site from 350 PSI to 1100 PSI.



24" 1500 PSI Fluid Booster operating in conjunction with a vertical Oil and Gas Separator and Gas Compressor.

30" 1000 PSI Oil and Gas Separator with 10" Water Leg and 24" 1500 PSI BOOSTER. Fluid is boosted from 800 PSI line into 1350 PSI line.

(Patented and Patents Pending)



FLOW DIAGRAM

APPLICATION

Usual application is in producing areas where well head pressures have fallen to a less pressure than the existing gas sale line pressure. Here the unit is used in conjunction with a gas compressor.

Typical of this situation is the Carthage Field in East Texas which is supplying gas to a 1050 PSI transmission and gathering line whereas the field producing pressures have fallen to 400-600 PSI.

OPERATION

The fully automatic unit operates as follows: The well product enters the separator where gas is separated and scrubbed of any entrained liquid. The liquid flows to the booster and gas flows to a compressor. When fluid level builds up in the booster to a prescribed level, a snap action control opens and closes simultaneously the two valves in the line from the discharge side of the compressor. No gas is vented when double valving is used. Pressure equalizes on the booster with that of the compressor outlet. The liquid then flows from the booster and is commingled with the gas downstream of the compressor and flows then into the sale line.

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TULSA, OKLAHOMA

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